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Greeting!

ONCE A YEAR it is pleasant to drop the thin anonymity of the nebulous 'We' and assume the intimately personal tone of the singular pronoun. I confess to a belief in a journalism that can be human as well as technical, that can be vital as well as scientific and, to speak frankly, I have no liking for periodical literature when its sole purpose is to serve as a lure for advertising. Something more than paper and printer's ink are needed. Character counts, for good or ill, in the making of a technical journal as in any other form of human endeavor. The MINING AND SCIENTIFIC PRESS has lived for 47 years because it has received the momentum given to it by dynamic men, by Alfred T. Dewey, Charles G. Yale, Alfred Holman, and J. F. Halloran in the past, and more recently by a group of men, some of whose names appear in the adjacent column. The inventions of Mergenthaler and Lanston have done wonders for the rapid multiplication of the written word, but all the automatic devices of mechanical genius cannot eliminate the value of the personal equation. It is the men behind the pulp that make the press, whether it be a yellow newspaper or a scientific review. And in no branch of periodical literature is this so evident as in that which mirrors the thoughts and deeds of the engineer. For the engineer is very much of a man, he is the least emasculated of the products of an advanced educational program and he vibrates to all the wireless pulses of his time and place. The discussion of civic duties and of professional ethics is as much the province of a technical journal as is the consideration of the best method of stoping or the cheapest way to erect a stamp-mill. Man does not live by bread alone. The training of clever men without any civic spirit, the development of young engineers adapted to winning big salaries, the digging of gold to make men rich—these are not the only purposes either of the universities or of those more instant mediums of instruction that take the form of newspapers. Such at least has been the idea underlying much of the matter that has appeared in these pages during 1907, and I speak, of course, not for myself alone but for a number of contributors. The columns of this journal have been honored during the past twelve months by the writing of such educators—using the word in its widest sense—as Rossiter W. Raymond, S. F. Emmons, James F. Kemp, James Douglas, and Courtenay De Kalb. In the furtherance of the application of geology to mining, of chemistry to metallurgy, and of good sense to both, there have appeared articles by James W. Abbott, L. S. Austin, Philip Argall, G. F. Beardsley, F. L. Bosqui, C. B. Brodigan, F. W. Bradley, Ross E. Browne, Charles Butters, W. R. Crane, J. H. Curle, Edgar Collins, J. R. Finlay, William Forstner, E. M. Hamilton,

F. Lynwood Garrison, Hiram W. Hixon, Ernest A. Hersam, Alfred James, Carlos W. Van Law, Thos. H. Leggett, Walter McDermott, Ben B. Lawrence, W. J. Loring, Waldemar Lindgren, James W. Neill, A. R. Parsons, John A. Reid, Thomas T. Read, H. W. Turner, and H. V. Winchell—in fact, a list of names that if given in full would read like a directory of the profession. If the MINING AND SCIENTIFIC PRESS has made progress in 1907—and I am proud to know that it has—the result is due to the generous support of a number of men possessed of a noble generosity, namely, the willingness to give, from the treasury of experience, the information and advice that money does not buy. Gentlemen, I thank you. 1907 closed amid a financial stringency no less astringent to this journalistic enterprise than to any other commercial undertaking, but the new year brings the assurance of progressive improvement and enlarged usefulness. It is my purpose to make this paper the spokesman for the profession of mining engineering; our columns are open to the free discussion of topics pertaining to the life and work of the engineer, the geologist, and the chemist, all of whom contribute their part to the development of the mining industry; it will be my pleasure to give publicity to opinions contrary to my own, always provided that they are expressed in good faith; it will be my aim to avoid taking sides in industrial quarrels, believing that a paper such as this should be just rather than partisan; in fine, it is my hope to develop the MINING AND SCIENTIFIC PRESS along the lines of an unattainable ideal—a paper useful to many and injurious to none.

T. A. RICKARD.

January 1, 1908.

WE TAKE PLEASURE in announcing that Mr. Edward Walker is now our representative at London. His office will be in Salisbury House, which is the headquarters of many members of the mining profession. We invite our English readers to keep in personal touch with Mr. Walker, who will be glad to receive suggestions likely to make this journal increasingly interesting and usefut to all those engaged in metal mining.

IN A POSTSCRIPT appended to our last issue, we notified our prospector friends that the bill for remitting the assessment work due on mining claims had not passed the Congress of the United States. It was approved by the Senate, but failed to reach the House of Representatives before adjournment for the holidays. It is stated that the Commissioner of the Land Office is opposed to the bill, and it is doubtful whether it will be passed when the Congress meets again during January. This failure to remove the obligation to perform $100 worth of work on each location will go hard on mining companies controlling a large number of claims on which stock has been issued and financial operations have been based, but it will hurt very few genuine prospectors.

WE LEARN from a friend that at Manhattan, Nevada, they read only Debs' *Appeal to Reason* and the San Francisco *Examiner*. Note the association. Do they give club rates for these two highly intellectual, refined, patriotic, and noble examples of modern literature? We are reminded of the fact that at a Denver meeting of sympathisers with Haywood, Moyer, and Pettibone, Mr. Eugene V. Debs was introduced by the chairman thus: "I, who expect to be in jail, introduce to you a man who has been in jail, who will speak to you in behalf of a man who is now in jail." This introduction needs editing; it ought to read: "I, who expect to be in jail introduce to you, *who ought to be in jail*, a man, etc." To return to Manhattan, if Debs and Hearst are the literary purveyors to that mining camp, we do not wonder that its boom has busted. The people of Manhattan had better improve their reading by getting Kemp on 'Ore Deposits' and Richards on 'Ore Dressing.'

AMONG THE ARTICLES in this issue is one by Mr. Alfred James. This cyanide specialist is in the habit at the end of each year of sending a circular letter to his brother practitioners and in his Epistle to the Cyaniders he summarizes the progress of the art that is symbolized by KCy. It is fair to say that these *obiter dicta* of Mr. James have a special value in that they are the expression of his personal opinion. For instance, his remarks concerniug filter-pressing devices should not be deemed offensive by the inventors or owners of other machines of the same type, for Mr. James is interested in the manufacture of the Ridgway filter and is pardonably partial to this clever invention. For the rest, anything written by so well informed an authority is sure to be interesting to our readers, for he has two qualities essential to useful writing—knowledge and sincerity.

NOTHING could be more timely than the article on mining booms by Mr. J. H. Curle, for we happen just now to be at the end of one period of excessive speculation and in a mood to listen to the moralist. Mr. Curle's contribution is characteristic; in the first place, it was posted at Colombo, in Ceylon, when the writer was on his way to Burma, and thus illustrates the nomadic activity that has made him so well informed concerning mining all over the world; secondly, it is written with the frank fearlessness that makes all his writings so effective. He is sometimes wrong, but never insincere; he is sometimes injudicious (in the eyes of a critic less friendly than the MINING AND SCIENTIFIC PRESS), but he is never the catspaw of a capitalist. There are not many men that can afford to be so independent of speech and so outspoken in criticism. Mr. Curle has followed his own advice in mining matters and has made money. This gives force to what he has to say and makes it less necessary for him to modify his remarks to suit the purposes of high finance and low promotion. Naturally, it is a pleasure to publish such an article as 'Psychology of Mining Booms' in our columns, for we are in accord with the tenor of his preachment. That booms are hurtful to legitimate mining, that mining is a speculation and not an investment, that directors ought to be trustees, that titled figureheads (whether a governor of Nevada or an Earl of Chesterfield) are mere lures to a deluded public, that mining engineers should

not gamble in mining shares—these are all unpalatable truths the recognition of which it is our province to enforce. Mining is an industry based upon the application of science, which is in itself only highly organized common sense; science is based on facts and on correct reasoning from facts; make-believe has no place in science and therefore none in mining.

CHRISTMAS is always celebrated in a pleasant way by the managers and men of the North Star mine, at Grass Valley, California. It is the custom for the company to give to each employee a gold coin, either a $5 or a $10 piece, fresh from the San Francisco mint. Mr. A. D. Foote, the manager, makes a pleasant speech, thanking the men for their co-operation and expressing the good wishes suited to the occasion. This is followed by refreshments, served in a prettily decorated room. Carols and speeches then ensue, and the general effect is to promote goodwill all round. Such was the case last week and we hope that it may happen with unbroken regularity for a hundred years to come.

NO ENDORSEMENT of the article by Mr. J. R. Finlay is needed; both the subject and the writer will commend themselves to practical men. Assuredly the comparative table of working costs, the preparation of which must have involved a great deal of work, will prove most suggestive to those in charge of mines. The inferences made by Mr. Finlay are open to discussion and we shall be glad to publish the views of other engineers on this vital subject. It is quite certain that the fundamental truths dug out of such statistical data are highly educating, in that they lead us to appreciate the factors dominating the financial success of mining operations. Mr. Finlay's experience in the copper and iron regions, followed by contact with actualities in Colorado and Idaho, gives him a strong grasp of the essential problems faced by the mine operator, and other engineers can pay him no better compliment than to discuss the points that he has elucidated.

DURING 1907 the affairs of the American Smelting & Refining Company passed through a crisis from which they have, we hope and believe, been successfully extricated. But those controlling this important industrial enterprise have made one blunder, the mention of which is timely. We do not refer to the fact that the Guggenheims have bitten off financially rather more than even this clever family is able comfortably to assimilate, nor do we refer to the stock gambling operations in which they have become, from time to time, involved; we refer particularly to the blunder, curious in a race marked by business sagacity, of trying to combine the executive and financial management with technical work. To speak plainly—and it is the only way worth anything—the Guggenheims are ambitious of being as expert in mining and metallurgy as they are skilled in the financial operations incident to the industry in which they have become so potent a factor; they want to be mining engineers and smelters, as well as financiers, as if to say: "We pay enormous salaries to these professional men; why should not we, or our sons, acquire the requisite technical training and so become independent of expert advice from outside the family." At least, this is how it looks to those at a distance, to whom the doings of the smelter people are at least as interesting as the performances of the Shah of Persia or the Russian douma.

Reports of Mining Companies.

THE beginning of another year renders it opportune to review the sources from which the world derives the gold that is both the standard of value and the great lubricant of commerce. Such a review will be found elsewhere in this issue. Any attempt to compile a trustworthy tabulation of the yield of individual mines in widely scattered regions develops the fact that the information so interesting to the public and so necessary to shareholders is furnished in a fashion as varied as the climates and clothes characterizing the localities in which gold mining obtains. In the premier goldfield of the modern world—the Transvaal—the Chamber of Mines obtains details of production from each operating company and publishes the information at the close of every month, so that exact data are available. But the periodical reports furnished by the South African companies are severely restricted to a statement of facts accomplished, there is rarely any account of developments underground and it is only at the annual meetings, as a rule, that shareholders learn much regarding future prospects. In consequence, while the financial houses controlling groups of mines are kept informed concerning the fluctuating value of the mining speculation that is represented by each mine, the small shareholder is in the dark and takes the chances of a blind pool dominated by clever financiers. At one time it was supposed that the mines of the Rand were fixed investments superior to the ordinary vagaries of gold veins and therefore there could be nothing particular to tell the shareholders save the chronicles of production. But this is a fallacy that has been exploded long ago and the iridescent films of the bubble lie scattered all over Throgmorton Avenue. The disillusionment is one of the reasons why the share market in South Africans is depressed, for, apart from the interminable labor troubles, the ordinary shareholder never knows when the quotation on his stock may drop suddenly, to learn subsequently that an unexpected change in the grade of the ore in one part of the mine, or an error in former estimates, or a structural disturbance due to a dike, has lessened the value of his mine and greatly diminished its earning capacity. Such untoward episodes are infrequent, but the unpleasantness of them is intensified by the absence of a frank statement, at regular intervals, concerning the developments affecting the life of the mine. Thus the typical South African company gives beautiful monthly and quarterly statistics and considers that enough. On the other hand, many American mines publish annual or semi-annual reports and, for the rest, they tell the minority shareholder that he has no particular reason for existing. Naturally, annual reports are not of much use to the

holders of stock in an investment so speculative as a mine, the value of which fluctuates weekly more than the amount of the dividend. Here also the shareholder, being in the dark, becomes a gambler against his will, for the uncertainties are needlessly multiplied. Finally, there are groups of mines controlled by financial houses and engineering firms that really act as trustees for the shareholders, whether large holders or small ones, and furnish all the information compatible with businesslike methods. The Indian mines managed by John Taylor & Sons, the Western Australian group directed by Bewick, Moreing & Co., and the Mexican companies controlled by the Exploration Company, are excellent examples of the better tendencies of modern mine management. Monthly reports of output, cost, and profit are given promptly, by cablegram, and these are followed by a detailed description of the developments underground, the nature of new discoveries, and the prospects at each level. Then, at the end of the year, a complete review of progress is given to the shareholders, together with an analysis of the work done and a fresh estimate of the ore reserves, accompanied usually by a luminous speech by a chairman of the type of Edgar Taylor or R. T. Bayliss, who is no figure-head, but a financial-mining authority of wide experience. Such proceedings give dignity to the business of mining and emphasize the proper status of the industry.

Another factor rendering comparisons occasionally unfair is due to methods of accounting. In the case of some West Australian mines, it is found that a lordly profit wilts away when 'depreciation' and 'development' are deducted. In such instances the 'gross profit' is magnified by treating 'depreciation of plant and machinery' as no part of the mining expense; even 'shaft sinking and development work' are put down as extras, instead of being vital necessities—as vital to a mine as ploughing to a farm. Machinery is debited to capital account as if it were everlasting and in blind disregard of the fact that when once the mine is worked out, the machinery is just so much scrap. But in these respects the business of mining has improved immensely; we have traveled far since the days when a false air of prosperity was given to a mining enterprise by treating timbers underground as capital invested; by considering machinery, even drills and other appliances subject to excessive wear and frequent repair, as fixed property; by regarding cross-cuts, nay, even a working level, as an item of development that bore no relation to current expense; and so forth. The one paramount item in a mining operation is the profit, which is ascertained by subtracting costs from receipts, and costs means everything expended in the complex operations of finding, breaking, extracting, and refining the metal.

Direct comparisons between mines are rendered difficult by the fact that the fiscal years of the companies controlling them end on different dates, although the majority issue statements for the calendar year ending on December 31. Other dates for closing the accounts are due often to the fact that the annual reports start from the birthday of the enterprise. Moreover the promptitude with which annual statements are given to the shareholders varies widely, from a few weeks after the fiscal year terminates to nearly twelve months later. Another obstacle to accurate comparisons arises from the different units of weight and value employed by English and American mining companies. You may wade through a statement of accounts and make your deductions, only to trip over the fact that some of the items are in terms of Mexican currency, while others are in American dollars. Some companies use long tons of 2240 pounds, others the metric ton of 2204.6 pounds, instead of the standard short ton of 2000 pounds. The student of statistics rises up and calls the Institution of Mining and Metallurgy blessed, for has it not done much to remedy this state of chaos!

No one can delve into an accumulation of annual reports issued by mining companies without remarking a coincidence, namely, the enterprises that are best managed are also the ones that give the most complete information to their shareholders. To this rule there is scarcely an exception. Those who are acting as real trustees for the shareholders are quite willing to give a frank and full statement of their stewardship; those who are either incompetent or untrustworthy will adopt the mask of secrecy or indirection. Publicity is the best cure for mismanagement and the most effective spur to right action in mining, as in other affairs.

An Interval.

IN MUSIC an interval has a value of its own; in life a period of idleness can be turned to harmonious account. By reason of the financial disturbance that marked the last quarter of 1907, there has been a curtailment of expenditure in every form of industry, and one of the immediate results has been to throw many professional men out of employment for a while. This period of enforced inactivity can be made as useful in the furtherance of a career as the intense engagement of busy days, if the opportunity be but properly utilized. Do not drift; do not go to your office merely to whittle a stick or whistle a song. If there is nothing to do, play golf and keep yourself physically fit against the time of active service that is coming again soon. Take the opportunity to study, to investigate matters that were put aside during the recent strenuous days. Accept the chance to make the closer acquaintance of other professional men. The knowledge of men is power and a large acquaintance is stimulating. You may find that the fellow in the office just across the hall is an unprospected gold mine of information and interest; you have only had time to nod to him as yet, now is your chance to be human and kind. Run a cross-cut and investigate. Perhaps you belong to a local technical or scientific society, the meetings of which you have as yet had no time to attend; you can go now. Go, by all means, and contribute your share to its usefulness. If necessary, organize a dinner and lubricate good fellowship in the old Anglo-Saxon way. Take out your note-books, put them in order, and systematize the odds and ends of information collected during your professional journeys.

Some of these memoranda are valuable to others besides yourself, arrange them in the form of an article and send them to the technical papers or to engineering societies. Whatever you do, keep awake and cheerful. This period of lessened activity in mining will not last long; prepare yourself for the moment when opportunity will knock at your door and call you forth to new labors. Make the interval count.

Retrospect and Prospect.

THE YEAR just ended has been big with events that throw strong lights and shadows across the future of America. History is no longer made by the birth and death of kings, by changes of dynasty, by battles, by conquests on land or sea. The only history worth anything is the story of human endeavor and the development of the character of a people and the individuals that compose a people. In this respect 1907 has been a great year, rich in lesson and bright with promise.

To many of our readers the exposure of wrong may seem to overshadow the achievement of right. We have seen the violation of the law, the falsification of accounts, and the secret rebates of the Standard Oil Company dragged to light, the legal proceedings initiated by the Government culminating in a $29,000,000 fine; we have seen the grand larceny of E. H. Harriman laid bare, his unscrupulous use of financial power in disregard of all obligations to shareholders, his use of company funds to gamble on a colossal scale; we have seen the post-mortem dissection of the New York traction company flotations and the disclosure of plundering of the most impudent kind; we have seen the collapse of a game of pyramids in which banks were made the sport of a group of plungers; we have seen a sudden panic, an extraordinary collapse of credit, and the spectacle of the rescue of the financial position by a coterie of very rich men, headed by Mr. J. P. Morgan—a rescue that carried with it the sinister suggestion that those who could so easily control the commercial equilibrium for good might likewise control it to their own ends. Finally, here in San Francisco, we have witnessed the exposure of corruption in municipal life, in business, and in politics; we have experienced the effects of an industrial vendetta, marked by brutal deeds and loss of life; we have seen educated men, rich men, men under obligations to support the State, we have seen them on the side of a lawlessness that was in effect anarchy and the year ended in a pitiful exhibition of labor tyranny as applied by the reckless ranter who had the impertinence to be a candidate for the mayoralty of San Francisco.

If the chronicle ended here, it would seem tragic indeed. If these wrongs were heralded without inciting an effort to redress them, the effect would only be to make us callous to the essential badness of such occurrences. But strong compensatory influences are already at work. In San Francisco the forces of corruption are deliquescing, public opinion has crystallized, civic spirit has been aroused; we have elected a mayor who is a scholar and a gentleman; the corrupting corporation and the corrupted labor union are both discredited, honest men need not apologize for living, the fog of a putrid kind of politics is being swept aside by the strong clear air of a brighter day. In national affairs, the aroused resentment of the people—not the dreaming head nor the subjugated feet, but the mass of ordinary plain folk constituting the strength of this continental country—has given strength to the Government's efforts to enforce the law against corporations doing an interstate business and the commanding personality of a President—American to the core, in his impulsive energy, his frankness, and his fearlessness—has given a rallying point to all the forces of reform. To anyone able to view the events of 1907 with any approach to mental detachment it is obvious that we have seen the expression of tendencies inherent in an industrial civilization under an undeveloped form of representative government. We can observe the interplay of rampant individualism, crass selfishness, and the misdirected greed for money, unchecked by law, in fact, using the law in self-protection, undisciplined by government, indeed, corrupting the government—of the municipality, State, and Nation—so as to go unhindered on its debauching way. But these constitute a passing phase. It is the measles and whooping cough of representative government in America. The very ills are creating antidotes more powerful than they, the very exposures of wrong are bringing into vigorous assertiveness the patriotic men able to guide the forces of reconstruction and upbuilding. San Francisco is a type of the United States; the earthquake and the fire, the breath of pestilence and the more pestilent breath of municipal corruption, the selfishness of the few and the ignorance of the many—not one of these, nor all together, has sufficed to stay the forces of reconstruction that out of a terrible desolation of smouldering ruin has caused to spring up, bit by bit, but surely and swiftly, a new city, finer and more safe than the old one; a city that on the stepping stones of her dead self shall rise to be the realization of the unconquerable spirit of man. We believe it, as we believe in the development of the kind of government that is called popular and is meant to be representative. There have been excesses, the excesses of youth—greediness, an unruly spirit, self-assertiveness. It is likely that to correct these tendencies we must have a severe dose of paternalism. The Federal Government must lay a heavy hand on all forms of industrial activity that reach beyond the boundaries of single States, and the law must be enforced to the annoyance even of well-meaning people. Commercial piracy must be checked, predatory finance called to order, the tyranny of corporations and labor unions alike curbed, and in the sequel the Government may have to perform many duties heretofore left to individual or corporate agencies. But beyond this era of paternalism, and during this period of discipline, there is the promise of the development of representative government such as the world has never seen, as much better than the anachronisms of Europe as the monarchies of the old world are better than the rule of a mob. We have full faith in the outcome; we are in the morning of the times, the world is young, and life an epic.

Personal.

C. W. MERRILL is visiting Goldfield.

MARK R. LAMB is now at Mexico City.

BEN. S. REVETT is here for the holidays.

A. C. BEATTY has returned to New York.

FRANK H. PROBERT is here, from Los Angeles.

CHARLES BUTTERS has returned from New York.

W. A. CALDECOTT has returned to Johannesburg.

H. P. GARTHWAITE is on his way back to Salvador.

HENRY HUNT, lately at Bingham, is here for a few days.

FREDERICK F. KETT, lately at Goldfield, is in San Francisco.

NORRIS ENGLISH has arrived in San Francisco from New York.

JOHN W. FINCH is at Denver, and will go to Europe shortly.

H. H. WEBB will leave San Francisco shortly, to proceed to Mexico.

H. H. LAING, lately at Kendall, Mont., is on a visit to San Francisco.

FREDERICK HELLMAN is expected at New York from Johannesburg.

ALEXANDER MCNEIL has left Halifax and will reside at Washington, D. C.

A. P. STANLEY MACQUISTEN, of Salt Lake City, was in San Francisco this week.

REGINALD W. BROCK has been appointed director of the Geological Survey of Canada.

OSCAR H. HERSHEY is now assistant to the editor of the MINING AND SCIENTIFIC PRESS.

R. T. BAYLISS has been elected a vice-president of the Institution of Mining and Metallurgy.

JOHN R. FARRELL, of the Tanganyika Concessions, Ltd., is at the Key Route Inn, Oakland.

ARTHUR W. JENKS has moved from Portland to Seattle, where his office is in the Alaska Building.

F. H. MINARD now has an office in the Trinity Bdg., New York, as well as his former office at Denver.

G. H. BARNHART, lately in British Columbia, is now manager for the Torpedo-Eclipse Co., at Ouray, Colorado.

C. C. BROADWATER, manager of the Little Mono mine, in Siskiyou county, Cal., is spending the holidays at Oakland.

J. M. BOUTWELL is expected at Los Angeles, from Cananea, where he has been making a geological study of the copper deposits.

F. B. CLOSE is now with the Compañia Metalurgica y Refinadora del Pacifico, at Fundicion, Sonora, as general superintendent of mines.

W. H. TREWARTHA-JAMES, of James Brothers, has returned from his recent mission to British Columbia and left for Mexico December 14.

J. E. SPURR, chief geologist for the Guggenheim interests, has arrived at New York after a three months' tour of properties in Missouri, Colorado, California, and Mexico.

JAMES F. BERRY, formerly with the National Metal Co., of Mexico City, has become chief chemist to the Compañia Metalurgica y Refinadora del Pacifico, at Fundicion, Sonora.

JAMES CHAMBERS DICK has been appointed general superintendent of the properties of the Tintic Mining & Development and Yampa Smelting Co. with headquarters at Salt Lake City. CHARLES W. SAXMAN, the general manager, will make his headquarters at New York hereafter.

Latest Market Reports.

LOCAL METAL PRICES—Jan. 2.

Antimony	12@16c	Quicksilver (flask)	$45.5
Casting Copper	17½@18½c	Spelter	6@ 6.75c
Pig Lead	3.85@ 4.80c	Tin	33@34½c

ANGLO-AMERICAN SHARES.

Cabled from London.

	Dec. 26. £. s. d.	Jan. 2. £. s. d.
Camp Bird	0 13 9	0 14 0
El Oro	1 1 3	1 1 3
Esperanza	1 8 9	1 9 0
Dolores	1 0 0	1 0 0
Oroville Dredging	0 13 9	0 13 0
Stratton's Independence	0 3 3	0 3 3
Tomboy	1 10 0	1 7 6 ex div.

(By courtesy of W. P. Bonbright & Co., 24 Broad St., New York.)

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date	Electrolytic Copper	Lead	Spelter	Silver
Dec. 27	13 5/8	3.50	4.13	52½
" 28	13 5/16	3.50	4.20	52½
" 29	Sunday.	No market.		
" 30	13 7/8	3.50	4.20	52¾
" 31	13½	3.55	4.25	53½
Jan. 1	Holiday.	No market.		
" 2	13½	3.55	4.25	54⅛

MINING STOCK QUOTATIONS—NEW YORK.

	Closing Prices. Dec. 26.	Jan. 2.
Alaska Mexican	5⅛	.....
Alaska Treadwell	27½	28
Bingham Central	¼	¼
Boston Copper	9½	10¾
Cumberland Ely	5½	6⅝
El Rayo	1¾	1¾
Guanajuato Con	2¼	2⅜
Giroux Con	2½	2½
Nevada Con	.....	8⅝
Nipissing	7⅞	6¼
Tennessee Copper	19¼	26
Tonopah Ex	1.25	1.50
Tonopah-Belmont	.....	0.69
Tonopah	5.37	4
United Alaska	.....	3⅝
United Copper	7	7⅛
Utah Copper	17½	20¾

(By courtesy of Hayden, Stone & Co., 25 Broad St., New York.)

SOUTHERN NEVADA STOCKS.

San Francisco, Jan. 2.

Atlanta	$ 28	Laguna	85
Belmont	69	Manhattan Con	23
Columbia Mtn	17	Midway	54
Combination Fraction	68	Mizpah Extension	10
Daisy	91	Mohawk	11.00
Fairview Eagle	40	Montana Tonopah	1.85
Florence	3.85	Nevada Hills	2.90
Gold Bar (Bullfrog)	38	Red Top	.....
Goldfield Con	4.60	Sandstorm	20
Goldfield of Nevada	.....	Silver Pick	28
Gold Kewanas	26	St. Ives	44
Great Bend	25	Tonopah Extension	1.25
Jim Butler	41	Tonopah of Nevada	4.10
Jumbo	.....	Tramp Con	17
Jumbo Extension	58	West End	33

(By courtesy of W. C. Ralston, 368 Bush St.)

COPPER SHARES—BOSTON.

	Closing prices. Jan. 2.		Closing prices. Jan. 2.
Adventure	2⅛	Michigan	9
Ahmeek	50	Mohawk	47
Allouez	28¼	Nevada Con	8½
Amalgamated	48	North Butte	43½
Arcadian	.....	Old Dominion	29
Atlantic	9	Osceola	86
Balaklala	1⅞	Parrot	10
Bingham Con	4½	Phœnix	75
Boston Con	10⅞	Quincy	81
Butte Coalition	15⅝	Raven	87
Calumet & Arizona	102	Rhode Island	2½
Calumet & Hecla	595	Santa Fe	2¼
Centennial	24½	Shannon	10
Con. Mercur	25	Superior & Pittsburg	10⅜
Copper Range	57½	Tamarack	65
Daly-West	7	Trinity	14¼
Franklin	7¾	United Copper com	.....
Granby	75½	Utah Copper	20½
Greene-Cananea, ctf	7	Victoria	4¾
Isle Royale	17⅞	Winona	4⅞
Mass	3½	Wolverine	115

The Actual Situation of Copper.

Written for the MINING AND SCIENTIFIC PRESS
By JAMES DOUGLAS.

The copper industry, like the rest of the country, has been living in a fool's paradise for the better part of two years, and finds it difficult to accommodate itself again to normal conditions of existence.

When the value of stocks of all kinds rises to fictitious figures, the value of commodities not unreasonably follows suit. Men believed that their paper wealth was real wealth, and spent accordingly, giving too often, however, paper checks in exchange for what they bought. And while this extravagant expenditure prevailed, to meet the demand for the articles wanted and to realize the extravagant prices paid for their commodities, the manufacturer forced production to a degree in excess of his actual legitimate resources and facilities. When the world returned to its sober senses and realized that things were not what they seemed, instead of soberly and reasonably reorganizing its business as well as its household expenses, it suffered a violent reaction of remorse and fear and fell into a panic for which there was no really good reason. This is eminently true of the copper trade. It has been passing through the same phases—first, excessive elation, then morbid depression, and now slow recovery toward reasonableness. No sensible man believed copper to be worth 25 cents or supposed that it would maintain that price; but the price, under abnormal conditions, kept soaring and the large mills kept buying ahead, to the loss of the producers and the mills' material gain, as long as the market continued steadily rising. Unfortunately for the owners of the mills they did not realize that the balloon was leaking gas, and therefore did not stop buying soon enough. Nor did the producers know or appreciate soon enough the extent to which the demand for the manufactured article had begun to decline. This really commenced in April and became pronounced in May; nevertheless, during the whole summer the mines and smelters continued pouring out their boom production, with the result that when the bubble actually burst they found themselves loaded with a lot of copper which it was inconvenient to carry. Some companies closed down their smelting works entirely and devoted their feeble efforts underground to picking up development work, which in the stress of production had fallen woefully behind. Others were only too glad to reduce production below the normal, and give their overworked staff a breathing spell. But others, especially in operating very low-grade mines, have maintained their output and continue to employ their full force.

In Arizona none of the big mines have been closed, and but few of the second and third class. In the Warren district it was considered by the Copper Queen and the Bonanza group good policy to reduce production, and therefore the smelting works of these two groups, which during the first three months of the year sent into the market 41,000,000 lb. of copper bullion, during the last three months shipped only 26,500,000 lb. The Clifton district, working on ore that does not average over 2½% copper, and contains no gold and silver, and where therefore administration expenses form a large proportion of the cost, have not reduced their production or abated their activity.

The Old Dominion furnaces have turned out during the past year approximately the same amount of copper as in the previous year, and there is no apprehension of a serious falling off during 1908. But forecasts are doubtful, as so many unforeseen contingencies arise, disturbing the most cautious calculations.

In the southwest the most regrettable incident of the recent depression has been the closing of the Humboldt smelter, on which the many small mines around Prescott had been depending for the treatment of their ore. It is to be hoped that the embarrassment of the company will be soon relieved. Custom works have run a very serious risk, and inevitably do so when the market has been as unstable as of late. They must pay small customers cash for their ores, and yet cannot realize the copper for approximately the three months during which the bullion is being transported to the East and refined electrolytically. Upon a rising market they gain and are liable then to reduce their smelting charges with a view to increased business, or put their gains into enlarged works for increased capacity. When, therefore, they come to lose heavily on a falling market, especially when there is such complete paralysis of trade as happened during the past summer, they are liable to become seriously embarrassed.

Were it not for the accumulation of stocks and the extraordinary increase in the cost of mining and smelting which have resulted from the so-called good times there need be no distress in the trade, for the present price is higher than that ruling in 1904, when the average for electrolytic copper was 12.823 cents. But during the prevalence of the high price of copper, every item that entered into the cost of the metal, increased to such a figure that it may safely be assumed that the cost of mining and smelting copper ore rose on the average three cents per pound over that prevailing before the period of exaltation. Wages, timber, fuel, and mining supplies increased in price. The railroads were unable promptly to handle such freight as they accepted, and the excessive local demand for Western fuel, or the convenient excuse of car shortage, obliged the smelters of the Southwest to import Eastern coke at very heavy cost. Had it been transported promptly and received when a high price was realized for the copper, its receipt would have been acceptable; but arriving still at this late date, it aggravates the embarrassment. Nevertheless, the values of what the companies have to consume are adjusting themselves to the lower price of what they have to sell, and when the process of re-adjustment is completed, which should not occupy a long time, and the trade has recovered its balance of mind, so acutely disturbed by 26 cent copper, it will be found that no one has been seriously hurt, except those who speculated recklessly in stocks or in worthless mines.

THE Standard group of mines at Bodie, California, has produced in 25 years $14,500,000. This output has been mined from a system of more than 100 veins, distributed through a zone about 2000 ft. in width; they varied in thickness from 0.5 in. of 'specimen rock' to 30 ft. of clay and quartz. The Bodie district occupies an island of Tertiary hornblende-andesite, surrounded by a complex of igneous rocks and breccias. The veins represent at least three distinct periods of formation. The oldest series, the Fortuna, is cut up into short segments, being dislocated by each of the succeeding ones. Its ore is characterized by hard, flinty, at times bluish, quartz. It has the largest percentage of silver of any of the system. The veins of the Incline series showed a relatively small proportion of coarse gold, and stood low in silver percentage. They have been classed as gash-veins, and their marked characteristic is the fading-out of value at about the 500-ft. horizon. The Burgess series has small, nearly vertical veins, with a slightly banded structure. The value was chiefly in exceedingly coarse gold. Their ore-shoots were included between east and west planes about 600 ft. apart, as against 3000 ft. for the Incline and 1000 ft. for the Fortuna series.

Psychology of Mining Booms.

Written for the MINING AND SCIENTIFIC PRESS
By J. H. CURLE.

My personal knowledge of mining goes back to the year 1891, but for the purpose of this argument it may be taken as beginning with the Transvaal boom of 1895. After that period of excessive mining speculation, there occurred the outbursts of Cripple Creek in 1895; New Zealand in 1896; Klondyke in 1898; British Columbia in 1898; Rhodesia in 1899; West Australia in 1899; West Africa in 1902; Egypt in 1904; Buenos Ayres in 1905; Siberia in 1906; Nevada in 1906; and Cobalt in 1906. There have been, during this period, many outbursts on a smaller scale, similar in character to these bigger occurrences, but these well known booms are enough for illustration.

These thirteen mining booms, following upon discoveries of more or less value, took without exception one definite course. After an initial period of scepticism results from one or two mines in the new district led to great financial excitement, and to wide advertisement. Outside promoters entered the field, and capital poured in; for one good mine twenty worthless ventures were floated; the shares, good and bad, rose to absurd prices; and the *facts* became obscured in an atmosphere of lying and brainless optimism. Then, sooner or later, came the crash. This was always thorough, and in each case dragged down thousands of more or less foolish and deluded people.

There is a law in these things. I have made the statement, not hard to verify, that these thirteen mining booms took a definite course. I shall go further and affirm that *all* mining booms take this course; for although there may be minor differences in their inception, all are based on slender material, in all are the same forces at work, and all result in eventual disaster. This law, which defines so surely the course of a boom, has many other manifestations. We may hope that a scientific generalization of its actions may one day be added to the world's knowledge. For our specific application, the dynamic forces at work may crudely be set forth as follows:

On the one side, making for moderation, we have the experience of very many booms, with their invariable over-valuation and certain disaster. We have also the sure knowledge that ore deposits are treacherous things on which to base hopes. On the other side we have the incurable fatuousness of human nature. This of itself is a force of the first magnitude, and it is supported by the company promoters, by the weight of capital, and by a large section of the press.

At the beginning of a mining boom these rival forces take the field. But how unequal they are! The struggle is a matter of form only. The *law* is at work, and there can be but one end. But what an immoral law, Nature! Truth, moderation, fair dealing between man and man, are doomed with certainty to go to the wall, for perhaps a period of years, while lies and foolish imaginings flourish.

Then for the mining boom in the abstract. Let us now take note how these things affect themselves. As miners, pure and simple, we don't want booms, for their aftermath brings disillusionment to the public, and consequent discredit to the mining profession. But are we, I wonder, prepared to say that this discredit is not merited, or do we, or do we not, as a profession, connive at the evils which flourish previous to, and during, a boom?

It is, of course, evident that the mining profession as a whole does not connive at these things, and stands for what is decent and legitimate. But the influence of the profession as a whole is a vague sort of force. It does not compare with the influence of those units in the profession who appear on the stage during the course of any given boom. It speaks with insufficient weight and prestige, and often, in order to placate the capitalists, speaks under its breath. About twice a year, as a consequence, the company promoter and his friends take the floor in a struggle for supremacy, and as often as this happens the mining profession gets struck across the head heavily with a club for trying in too feeble a way to speak up for what it knows to be the truth. If we were efficient there would be no booms, for we should control public opinion, and mines would be valued rationally. But seeing that the opposite state of affairs obtains, that is, continuous over-valuation of mines, verging frequently into booms, it is evident that there must be much inefficiency in our ranks.

Let us analyze this. A few technical men are habitually dishonest; a larger number, afraid for their billets, look on while their directors manipulate things. A still greater number bear no influence at all, for good or ill. Their views as to the values of mines—about which booms wax and wane—are as indefinite as their characters. These are the kind of men that bring mining into disrepute and make booms possible. Their influence more than outweighs that of the rank and file of straightforward competent men who direct the mining operations of the world. The able men of the period, made wise by experience, view the recurring booms rather cynically than otherwise. They gamble, probably, but knowing as by instinct which are the good mines, buy into these and take out good profits before the boom reaches its height. They see one after another of their less gifted fellows making fools of themselves; one in writing an unduly optimistic report; another in allowing himself to be made the whipping boy for his director's trickery; and a third in plunging into scrip just as the crash comes. These astute individuals look on. They understand the forces at work, with their inevitable results, and play their cards accordingly.

In the presence of a mining boom we are as helpless as the medical profession in presence of an epidemic. The one is as surely a disease as the other, and should be stamped out at its inception. Neither, indeed, should be allowed to germinate. This line of reasoning is, I feel sure, correct. I know there are those who argue that booms have their uses; that they encourage the flow of capital into mining, and that by allowing the able to score at the expense of the fools they carry out nature's laws of the survival of the fittest. Well, there is a good deal in this. The love of gambling cannot be eradicated by official decree of the mining profession, and if people don't gamble in mines they will in other things. I gamble myself, now and then, but I am still prepared to argue that the profession is better without these periods of excitement, founded as they are on lying and unwarranted optimism, and I believe that the final weight of opinion will endorse this view. If we could present a united front of strong able personalties against the powers of darkness—represented in this case by human fatuousness, backed by the promoter and his myrmidons—there would be no more booms, for they could not generate in such an atmosphere. Taking things as they are, we realize that the profession carries its due share of undesirables, that we cannot get rid of them, and therefore that these evils will continue to exist as in the past. The boom will come, with its attendant evils, and the official voice of the profession, raised in warning, will be as ever, calmly ignored by the world. But it is worth while to protest.

What there is to do rests with the individual. Let him, in the crisis, be guided by facts, and facts only. He must not lose his head. With slight reflection he will realize that the boom will be followed by certain disaster, and that the good name of mining will suffer. He must do what he can do to preserve this good name. No flabby reports, meaning anything or nothing, must be written; no elastic estimates of ore in reserve must be made; there must be no cringing to boards of directors over matters of right and wrong; and nothing must be conceded where a delicate sense of honor calls for the truth.

RAILROAD RATES IN MEXICO.—The Federal Railroad Commission has recommended to the Department of Communications increases of 10, 20, and 30% on the three respective classes of ores as established and asked for by the railroads. Ores are to be divided into three classes, as follows: Up to P25 value per ton the increase in freight rate will be 10%; ores from P20 to P50 per ton in value, 20% increase; and ores exceeding P50 per ton in value, 30% increase. It is entirely probable that the new rates as recommended by the Commission will be adopted by the Government. However, owing to the crisis through which the mining industry in the country is passing, in the progress of which a number of mines are being closed down, owing to the depreciation in the price of metals, it has been deemed inexpedient to put the new increased rates into effect at once, and this point is now under consideration. The mining industry gets off better than it had reason to expect, as the increases to be recommended are far lower, on the whole, than the railroads were demanding. As an example of what mining is to the railroads the last annual report of the Mexican Central shows that out of a total of 3,545,538 tons of freight handled up to June 30, 1907, 1,931,840 tons consisted of ores, metals, fuel, material, machinery, etc., carried to or from mining camps. The report of the National Lines showed that 48.61% of their freight traffic was due to the operation of mines and smelters.

COPPER ranks third among the products of California's mines. The order of value in California's principal mineral products is, gold, petroleum, copper, clays and their products, cement rubble, and quicksilver.

Production of Precious Metals.

By the courtesy of Mr. Frank A. Leach, Director of the Mint, we are enabled to publish his preliminary estimate of the production of the precious metals in the United States in 1907, and a comparison with 1906. These figures are based on the exact receipts of the various mints and assay-offices for 11 months, and refinery and smelter statements for from 9 to 11 months.

The table herewith shows a reduction in the gold yield of the United States for 1907, the estimated total production this year being $89,617,007 as against $94,373,800 for 1906.

There is but little difference in the total production of silver, the apparent yield in 1907 being 56,925,911 fine ounces as against 56,517,900 for the year 1906.

The gold recovered from the copper ores of California in 1907 will amount to about $2,188,000, an increase of about $898,000 over last year's product from that source. The yield of gold from the other sources of mining show a falling off of about $2,340,000, making the net loss, in round numbers, $1,500,000 in the gold yield of California.

The shrinkage in Colorado is about the same as for the previous year.

The large falling off in South Dakota is due to labor disturbances and the fire in the big Homestake mine.

For the first half of the year the output from the mines of Utah, Idaho, Montana, and Arizona indicated increased yields for these States, but the sudden drop in the selling price of those metals which gave gold as a by-product caused a great curtailment in the yields of these mines in the last part of the year by reason of the closing down of many of the big producing mines.

The world's gold product for 1907 is estimated at $103,000,000, or a gain of about $4,500,000 over the preceding year. Africa will give a gain of about $17,000,000, which, with gains of $1,000,000 elsewhere, gives a total gain of $18,000,000. On the other hand the losses will be about as follows:

United States	$4,700,000
Australasia	5,000,000
Other regions	4,100,000
Making a total of	$13,800,000

thus reducing the gain to $4,500,000, and it is likely that the final figures may reduce this excess somewhat.

PRODUCTION OF GOLD AND SILVER IN THE UNITED STATES.

Source.	1907. Gold.	1907. Silver. Fine ounces.	1907. Silver. Commercial value.	1906. Gold.	1906. Silver. Commercial value.
Alabama	$ 25,238	$ 57	$ 37	$ 23,500	$ 68
Alaska	18,251,610	148,609	98,081	21,365,100	137,747
Arizona	2,539 516	2 715,564	1,792,272	2,747,100	2,000,822
California	17,394,363	2,326,184	1,878,073	18,832 900	1,027,180
Colorado	20,898,833	11,648,136	7,687,769	22,934,400	8,425,520
Georgia	11,502	282	186	23,700	203
Idaho	1,087,655	6 977,718	4,605,294	1,035,700	5,981,135
Michigan	.....	328,520	216,823	.....	125,969
Missouri	6,759	125,000	82,500	.....	21,187
Montana	4,206,345	12 118,000	7,997,880	4,522,000	8,488,104
Nevada	14 704,658	7,767,510	5,126,556	9,278,600	3,524,972
New Mexico	235,221	431,246	284,622	264,200	306,902
North Carolina	73,419	10,627	7,013	90,900	16,719
Oregon	1,179,988	83,263	54,953	1,320.100	61,391
Porto Rico	1,219	5	3	.....	.....
Philippine Islands	5,766	86	56	.....	.....
South Carolina	59,033	28	18	74,600	68
South Dakota	4,085,446	93,011	61,387	6,604,900	105,053
Tennessee	1,756	25,210	16,638	800	17,328
Texas	992	307,545	202,979	3,400	187,769
Utah	1,652,941	11,747,562	7,753,390	5,130,900	7,789,650
Virginia	11,327	120	79	10,300	68
Washington	155,015	70,707	16,666	103,000	28,497
Wyoming	3,245	915	603	5,700	745
Other States	1,157	6	4	.....	.....
Totals	$89,617,007	$56,925,911	$37,913,881	$94,373,800	$38,256,400

The commercial value of fine silver in 1906 averaged about 68c. per ounce.
The commercial value of fine silver in 1907 averages about 66c per ounce.
The production of fine silver in 1906 amounted to 56,517,900 ounces.

The Great Gold Mines.

Written for the MINING AND SCIENTIFIC PRESS
By T. A. RICKARD.

The most productive gold mine in the world in 1906 was the Esperanza (at El Oro, Mexico) which yielded $7,708,883; it was also the most profitable gold mine, for the profit won in that year amounted to $4,644,279. The most productive gold mine in the world in 1907 was the Goldfield Consolidated (at Goldfield, Nevada) from which $6,296,476 was extracted, but it was far from being the most profitable mine during that year. The most profitable gold mine in 1907 was the Robinson (at Johannesburg, in the Transvaal) the earnings being estimated at $4,300,000. The greatest gold mine in the world today, having regard to the present rate of production, the profit earned, and the magnitude of its ore reserves, is the Robinson. These statements summarize a careful review of the performances of great gold mines in widely scattered regions.

In preparing a list of the great gold mines, it was intended to mention all those that yield $1,000,000 per annum, but this would have furnished a statement lacking in variety, for of the 80 mines fulfilling such a condition, no less than 53 are in the Transvaal. This fact emphasizes the dominant position of South Africa among the regions producing gold. But it is scarcely more than was to have been expected, for Africa produces 30% of the total production of the world, and the single district of the Rand yields more than either the United States or Australia, the two countries ranking next in production. Out of the 53 South African mines yielding over $1,000,000 per annum, I quote statistics for the 19 most productive. Each of these 19 mines now contributes 10,000 ounces of gold per month, that is, abont $2,500,000 per annum. All the ore is crushed in stamp-mills, ranging in size from 100 to 360 heads. In many cases tube-mills are used for re-grinding, with the further result that the rate of crushing is increased. The average duty is 5.67 tons, with a maximum of 8.8 tons per stamp per day. From the 66 productive mines on the Rand in August, 1907, for example, the total profit in that one month aggregated $4,400,000. The profit yielded by 63 of these amounted to $4,258,441, which was the result of treating 1,317,799 tons of ore. The average yield was $8, the profit was slightly over $3, and the working cost slightly under $5 per ton. One-half the companies were working ore yielding a profit of less than $2.50 per ton. Of the 32 leading companies, 15 earned a profit of between $1.80 and $2.50 per ton, 8 won between $1.25 and $1.80 per ton, and 9 got under $1.25 per ton. In the next month (September) the 19 leading mines varied in their earning capacity from a profit of $2.22 per ton to a maximum of $8.79 per ton.

Among the mines of the Rand, the Robinson and the Simmer & Jack are in a class by themselves. Each of these two mines is yielding over $500,000 per month and the two properties contribute about $12,500,000 per annum or 3% of the entire output of the world's production. The Robinson is now earning at the rate of $4,500,000 profit per annum and the Simmer & Jack a little over $2,500,000 per annum. In October the Robinson made a profit of $376,390. During the year ending June 30, 1907, the 320 stamps of the Simmer & Jack crushed 717,524 tons of ore, yielding $5,595,537, of which $2,363,308 was profit. The average duty was 6¼ tons per stamp per day. The dividends amounted to £300,000. The yield per ton was $7.80; the cost, $4.51; and the profit, $3.29 per ton. Of the ore hoisted 16.83% was sorted out. It is calculated that the ore already developed amounts to 1,694,000 tons, that is, a supply sufficient for a little more than two years, and the average content of these reserves is 7.7 dwt. per ton. The undeveloped reserves, that is, the tonnage of ore estimated to exist within the boundaries of the property, amount to 11,000,000 tons.

In the year ending December 31, 1906, the Robinson yielded 435,474 tons, of which 74,103 tons was sorted out. The ore sorted out represented 17% and it assayed 1.005 dwt. per ton. The assay value of the ore milled was 14.26 dwt. and the actual yield 13.288 dwt., or 93% of the contents. The 210 stamps ran for 336 days, the duty averaging 5.13 tons per head. Three tube-mills were added to the plant. On December 31, 1906, this company was employing 462 white men, 146 Indian coolies, and 2461 Kaffirs. While the ore developed in this mine at the end of 1906 was estimated at 2,180,700 tons of an average assay value of 14.22 dwt., the ground covered by the property is calculated to contain sufficient ore to last 12 years, that is, it contains between 4,500,000 and 5,000,000 tons of ore equal in richness to that now being extracted.

An example of the eventual exhanstion even of the best of mines is afforded by the Bonanza, which up to the end of 1906 had yielded $13,257,528. Being a property of small area it serves to emphasize the fact that the individual mines of the Rand have no apex rights and therefore cannot follow the dip of the lode under adjacent ground. The possibilities of deeper exploration are cut off sharply and there is no hope of postponing the

PRINCIPAL MINES OF THE TRANSVAAL.

	Stamps.	Per annum.			Per ton.			Waste sorted.	Reserves.
		Tons.	Yield.	Profit.	Yield.	Cost.	Profit.		
			$	$	$	$	$	%	Tons.
Robinson	210	362,367	4,982,117	3,067,053	13.74	5.29	8.46	16.79	2,180,700
Simmer & Jack	320	673,784	5,204,701	2,074,752	7.72	4.64	3.08	16.72	1,215,291
Robinson Deep	300	451,566	4,592,605	2,183,475	10.10	5.30	4.80	18.11	1,832,225
Ferreira	120	252,625	3,178,901	.....	12.58	.....	.....	18.12	1,231,591
Village Main Reef	220	419,648	3,493,535	1,254,103	8.32	5.34	2.98	20.00	.....
Ferreira Deep	120	251,721	3,080,605	1,831,520	12.23	5.00	7.23	18.93	.....
Knights Deep	158	395,568	2,985,383	956,120	7.54	5.38	2.16	20.60	761,620
Nourse Mines	180	334,485	2,893,754	896,478	8.65	5.97	2.68	12.62	1,116,051
New Kleinfontein	200	378,519	2,826,386	852,602	7.46	5.21	2.25	28.01	947,038
Crown Deep	200	241,464	2 770,926	1,181,196	8.11	4.65	3.46	10.26	1,451,881
Witwatersrand Deep	200	335,880	2,752,287	.....	8.19	.....	.....	15.77	.....
Angelo	138	257,142	2,678,393	1,103,121	10.41	6.20	4.21	5.33	808,882
Robinson Central Deep	100	201,095	2,587,829	1,787,159	12.86	3.98	8.88	8.22	507,522
Simmer & Jack East	240	431,874	2,565,082	328,834	5.91	5.18	0.76	13.04	609,800
Van Ryn	120	266,940	2,521,568	967,827	9.44	5.82	3.62	21.39	1,119,600
Geldenhuis Deep	200	303,325	2,485,465	773,115	8.19	5.64	2.55	12.41	2,056,994
Witwatersrand	220	374,000	2,455,715	.....	6.56	.....	.....	17.65	1,035,864
*Cason	211	239,636	2,428,224	1,069,714	10.13	5.67	4.46	15.94	602,820
Rose Deep	200	315,650	2,274,242	673,697	7.20	5.07	2.13	26.29	1,563,191

*Seven months only.

The records given in this table are for the year ending December 31, 1906. Fine gold is taken at $20.67 per oz. and the pound sterling as equivalent to $4.85. In October, 1907, the Robinson brought costs down to 14s. 9d. or $3.56 per ton, and made a profit of £77,606 or $376,389, on an output of 25,298 oz. fine gold. In August the Robinson transferred £50,000 from the gold reserve to current output, making a maximum month's production of $735,760, of which $582,175 was profit.

end of productiveness as in most mines operated under the American law. Another example is that of the Jumpers Gold Mining Co., whose mine is to be exhausted by December, 1908, by which time the 112,000 tons in reserve on July 31, 1907, will have been extracted. The lode so profitably worked by the Jumpers will be followed downward by the Jumpers Deep, into whose territory it dips.

The regularity of production characteristic of the South African mines is to be credited not wholly to the comparative uniformity of the ore and the ability of the manager to overcome variations in the gold content of the material coming from different stopes; it is due, in large part, to the practice of holding a reserve of bullion, which is used to sweeten the output when, by reason of any untoward event, it fluctuates below the normal. This reserve ranges from 1000 to 5000 oz., with even larger amounts in the case of the biggest mines; thus, in September the Robinson carried a reserve of 16,109 oz.; the Robinson Central Deep, 10,996 oz.; and the Crown Deep, 10,521 ounces.

After the Rand the most productive district is Kalgoorlie (in Western Australia), which in 1906 yielded $20,430,000 and in 1907 about $18,000,000. Out of the $9,661,500 dividends paid by West Australian gold mines in 1906, no less than $7,651,050 came from ten mines at Kalgoorlie. These are contiguous to each other in a small tract of schistose diorite so thickly traversed by rich orebodies that it is known as the Golden Mile. Kalgoorlie was discovered in 1893 and reached its most productive stage in 1903, when this district (called officially East Coolgardie) yielded gold worth $21,970,101, out of the $40,427,558 credited to the whole of Western Australia. Since then closer attention to economy and improvements in the metallurgical treatment have lessened the working costs, so as largely to balance the decline in the tenor of the ore. Although lower grade in depth, the ore has proved persistent in several of the big mines. The deepest stopes are in the Great Boulder at 2050 ft. At the end of 1906 this mine had reserves of ore amounting to 548,490 tons, estimated to contain 501,376 oz. of gold, worth $10,000,000. The Oroya-Brownhill and Golden Horseshoe each produced close to $3,000,000 in 1906. The Golden Horseshoe had four years reserves assured, the 993,000 tons blocked out being estimated to contain $14,000,000 in gold. The deepest workings were at 1600 ft. The Oroya-Brownhill, up to the end of 1906, had produced $20,775,000 from the two mines now consolidated under the compound name; the present company having extracted $13,390,850. The maximum depth is 1500 ft. In 1906 this mine yielded £630,318 and made a gross profit of £501,932, from which £46,811 was deducted on account of depreciation and £26,560 for shaft-sinking and development. The cash in hand, after paying dividends amounting to 80% on the capital, was £300,000. In 1903 the working costs were $6.78 per ton; in 1904 they were reduced to $6.48; in 1905, $6.04; and in 1906 they were brought down to $5.28 per ton — so that ore carrying 5 or 6 dwt. can be worked at a profit. The crushing capacity of the mill has been increased from 5½ tons per stamp in 1904 to a duty of 7½ tons in 1906. The Great Fingall Consolidated is an example of the proverbial tenacity of English shareholders, for the first mine upon which the company was organized having proved a failure, the directors acquired the Day Dawn mine, near Cue, and from it the company has paid $7,375,000 in dividends. Now that it shows signs of exhaustion, the directors are looking for a new property and they have been considering the acquisition of the old Burra Burra copper mine in South Australia. Similarly, the Ivanhoe company has sent engineers to Mexico and the negotiations for the purchase of a property there only broke down by reason of the high price asked. The most amusing instance of this kind was that of a company that was formed to work a mine in New Zealand and then shifted the scene of its operations to a mine in India, and when this became impoverished it acquired property in Madagascar. The mines die, but the company goes on. This method has the merit of conserving experience.

At one time, in 1899, Kalgoorlie boasted the most productive gold mine in the world, for in May of that year the Lake View Consols yielded 33,160 oz., worth about $660,000, and in the 12 months it gave 199,230 oz., or $3,897,479. Shortly afterward it became the centre of a disgraceful fiasco, followed by bear raids and exposures affecting neighboring mines, until Kalgoorlie became a name of ill repute. Since then systematic management and the best engineering skill have done much to restore the local industry to a healthy condition. As with men, so with mines, good behavior is apt to come after the vigor of youth is past.

The gold-mining district ranking third is Cripple Creek, in Colorado, which in 1906 produced $14,250,000 and in 1907 about $13,000,000. At the present time Cripple Creek can claim no mine of the first magnitude and a large part of the production comes from small properties operated under lease. But this district, famous for its telluride ores, its labor troubles, and its stock boom can boast at least two mines that at one time commanded general attention. These two are the Portland and Independence, which are contiguous and on the same system of veins, traversing andesite breccia where it is crossed by numerous dikes of phonolite. The Independence was discovered by W. S. Stratton on July 4, 1891. Since its discovery in 1891 it has produced fully $17,000,000. To the English company to which it was transferred in April, 1899, it has yielded a profit of over $5,250,000, and to the lessees during the past three years it has given a further profit, not included in the above total. Divi-

LEADING MINES OF AUSTRALASIA.

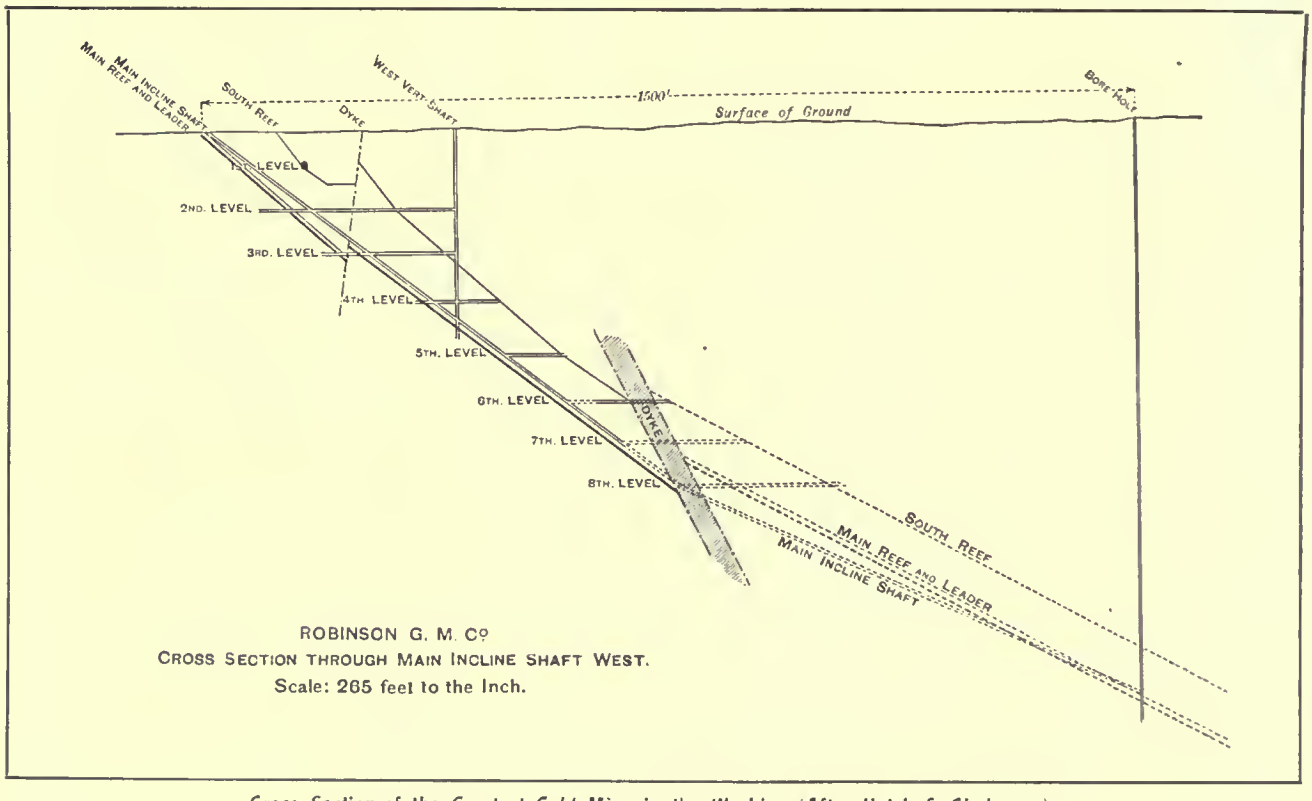
Mine and State.	Production for the year.			Per ton.			Reserves, tons.
	Tons.	Gross yield.	Profit.	Yield.	Cost.	Profit.	
Mt. Morgan, Queensland	334,953	$4,531,994	$1,863,725	13.53	8.87	4.66	2,500,000
Waihi, New Zealand	328,866	4,001,250	2,435,054	12.16	7.40	4.76	1,029,658
Great Boulder, West Australia	149,943	2,690,770	1,653,251	17.94	7.61	10.33	548,490
Gt. Boulder Perseverance, "	169,424	1,666,484	518,077	9.83	6.81	3.02	383,400
Oroya-Brownhill, "	128,180	3,049,791	2,305,551	23.79	5.73	18.06	.....
Golden Horseshoe, "	243,619	2,945,810	1,206,759	12.09	7.14	4.95	992,867
Ivanhoe, "	185,967	2,531,248	1,257,513	13.61	7.85	6.76	932,551
Kalgurli, "	120,150	1,730,747	800,817	14.40	7.74	6.66	650,000
Associated, "	128,358	1,127,159	*465,050	8.78	5.16	3.62	330,278
Great Fingall, "	249,646	2,515,486	1,131,922	10.07	5.54	4.53	.....
Sons of Gwalia, "	136,282	1,151,050	359,045	8.44	5.81	2.63	343,000

*From which $315,788 was charged off to mine development and depreciation of plant.
The outputs for this list are for the calendar year 1906, except in the cases of the Kalgurli mine, which is for the 12 months ending on June 30, 1907, and the Mt. Morgan, whose fiscal year terminated on May 31, 1907.

dends declared by the Stratton's Independence company aggregate $5,028,568. To Stratton himself the mine yielded a profit of $2,500,000 before he sold it. For the year ending June 30, 1906, the output was 75,260 tons, yielding $1,245,121, out of which the company got a profit of $340,965. In the year ending June 30, 1900, this mine also has been the scene of queer doings; early in its development it became controlled by a group of illiterate men and the vagaries of one of the most ignorant of them have involved the mine in a series of lawsuits and recriminations. Despite bad management, it has proved a great bonanza. To the end of 1906 the

Witwatersrand Deep Mine. A Typical View of the Rand.

this mine yielded gold to the value of $3,500,000, of which $2,000,000 was profit. After 16 years of productiveness, after having been the basis of an extraordinary flotation, the subject of a fiasco that caused the loss of money to many, and the excuse for a big lawsuit that Portland had yielded $25,034,411 from 775,110 tons of ore, yielding $7,147,080 in dividends. The biggest production was in 1903, when the mine yielded $2,608,993 from 90,244 tons. During 1906 the output was 92,265 tons, worth $1,817,256, from which a profit of $512,106



Cross-Section of the Greatest Gold Mine in the World. (After Hatch & Chalmers.)

was intended to drag an aniseed bag across the trail of financial misdoing, this splendid mine is now worked out; there remains a big dump of low-grade stuff, but the Independence has had its day—a day checkered by some romance and a good deal of spoofery. Next to it is the Portland, which was discovered in the same year. was made. This mine has seen its best days, although not without some resources.

After Cripple Creek comes the Kolar district, in the State of Mysore, India. A group of nine mines yields $11,000,000 per annum. In 1905 the maximum output was attained, namely, 627,700 ounces, worth $11,639,928.

The ground on which the mines are situated is part of a concession granted by the Mysore government in 1881. At the present time the Mysore is the most productive of this group, yielding 17,000 oz. per month. In 1906 this mine produced 185,900 tons of ore, yielding 205,918 oz., worth $3,925,652, giving a profit of $2,231,068. The reserves are stated at 747,000 tons, or a supply sufficient for four years. The deepest workings are at 3500 ft. on the pitch of the ore-shoot, which is in schist. The system of working this mine is remarkable from the fact that the working shafts have been sunk on the pitch of the shoot, not on the dip of the vein. The pitch is about 30° from the horizontal. The bottom workings look healthy. The dividends to the end of 1906 amounted to $23,402,300 on an original capital of $1,479,250 or £305,000. In 1906 the Champion Reef was nearly the equal of the Mysore, but it has declined notably since then, so that at present it yields only 10,000 oz. per month. In the year ending September 30, 1906, the Champion Reef mine produced 203,174 tons, yielding 177,641 oz., worth $3,291,724. From this a profit of $1,685,903 was made. Of the other important mines, the Ooregum and the Nundydroog yield from 5000 to 6000 oz. monthly. On the whole, the Kolar goldfield has repeatedly surpassed reasonable expectations and the recent developments in depth encourage the expectation of many years of steady, though slowly declining, productiveness.

The district ranking fifth is El Oro, in the State of Mexico, and about 90 miles northwest from the city of Mexico. Here there are three big mines and one of the very first magnitude. The Esperanza and El Oro are on the same lode, the San Rafael vein, while the Dos Estrellas is on a parallel system of veins traversing the same ridge of schist, which is covered with a cap (600 ft. thick) of andesite. The Esperanza was worked by an American company before it was transferred to a London corporation in 1903. For a while it proved a disappointment, but the discovery of a wonderful bonanza, at the end of 1904, prepared the way for a tremendous output. The discovery of an entirely new rich vein was made by diamond-drilling. At one time the Esperanza was much the most productive gold mine in the world. During the month of November, 1905, the output was 10,164 tons, yielding $748,535, or even better than the Lake View Consols when at the top notch. The profit for that month was $473,946. The Esperanza mine continued in bonanza during 1906, the output for the calendar year being 207,183 metric tons or 228,419 short tons, having a gross value of $7,708,883, from which a profit of $4,644,279 was earned. In 1905 the output was 204,299 tons, containing $5,101,135, yielding a profit of $2,923,212. Up to the end of 1906 this mine has yielded (to the various companies that have owned it) no less than 38,347,918 pesos (about $20,000,000) from an output of 871,992 metric tons. Of the output for 1906, 144,286 metric tons were milled and 62,897 tons were shipped to the smelters. The cash on hand and unrealized ore were estimated at $2,221,817. The reserves of ore in the mine were calculated at 141,663 metric tons, expected to yield a profit of $1,481,307. It is obvious that the record for 1907 will fall far short of the two past years and that this mine must lose its premier position. At the present time the Esperanza is producing at the rate of $2,750,000 per annum, of which $1,250,000 is profit, so it is still one of the big fellows, although without any assurance of a maintenance of this rate of production for even a year longer. The workings are only 800 ft. deep, while the adjacent mine of El Oro (to which the district owes its name) is 1100 ft. deep. During the 3½ years of the present company's existence, the Esperanza has produced 541,421 metric tons, yielding $14,407,958, of which $7,631,737 has been profit.

The El Oro was worked by the Mexicans before it was purchased by J. B. Haggin, by whom it was sold to the present English company in 1898. During the year ending June 30, 1907, this mine produced 260,304 tons, yielding $2,243,468, of which $1,902,185 was gold and the remainder silver. The total working costs averaged $5.01 per ton, and the percentage recovered in the mill was 86.63. It is estimated that the reserves of ore amount to 532,523 tons, containing an average of $8.44 per ton in gold, besides 3 oz. silver. Dividends for the year totaled £126,000.

The Dos Estrellas mine is controlled by J. G. Fournier and his friends, who operate under a Mexican organization. The production for the year ending December 31, 1906, was $2,230,360 in gold and $743,797 in silver, making a total of $2,974,157, with a net profit of $970,800. In the report these amounts are given in Mexican currency and I have divided them by two to convert them to American units. The reserves of ore are stated to be 4,000,000 tons.

Of the three mines above reviewed, the El Oro is exhibiting a surprising improvement on the lowest level, suggesting that a sulphide zone of profitable exploitation may succeed (after an interval of almost barren ground) the upper zone of rich oxidized ore, and the Dos Estrellas, being now equipped with a new cyanide plant, is expected to maintain a large production for many years. Another mine—the Mexico—which adjoins the Esperanza, and is on the same lode-channel as the Esperanza and El Oro mines, promises to win a position in the first rank of mining enterprises, but as milling operations only started in 1907, there is no large output to record yet.

(TO BE CONTINUED.)

ELECTRIC SMELTING OF COPPER. — The use of electrothermal processes for smelting copper ores has been proposed in recent years, and in a few cases experimentally tested. The whole question depends on the recognition and appreciation of a few fundamental facts. By far the great bulk of all copper ores are sulphide ores, and in many cases the sulphur and iron present are sufficient heat-producers to allow of the smelting of the ore simply by the heat of their oxidation, if the operation is skillfully conducted. Such is the basic principle of pyritic smelting, and whenever it can be applied it is very economical to do so, and electric processes have no chance of an application. Other ores of copper contain so small an amount of the metal that the result of the smelting down of the whole to a fluid mass by any method of fusion would not repay the cost of the operation. Some such ores can be treated by aqueous and other methods not involving fusion, with a margin of profit to pay for the operation. The only field for electrothermic processes appears to be in the smelting down of ores carrying too little sulphur to be pyritically smelted, and which require, as usually treated, the use of carbonaceous fuel to assist the fusion. Wherever such fuel is expensive and electric power may be obtained at a low price, an electrothermic process might be theoretically possible and profitable. Such conditions may easily occur in the vicinity of copper mines. Situated frequently among the mountains, remote from railways and cheap fuel, they frequently are near large water-powers that would furnish cheap electric power. Some may be even so situated that concentration of a lean sulphide ore to matte by use of fuel or by mechanical concentration would be unprofitable, and yet a concentration or simple melting to matte by electrically-generated heat be profitable. There are no electrothermal processes yet in commercial operation on copper ores, yet they have been tested experimentally with promising results.—J. W. Richards.

Method of Collecting Statistics.

By WALDEMAR LINDGREN.

*The statistics of gold and silver collected from the mines by the Geological Survey are obtained from the following four items: (1) Gold and silver in placer bullion produced during calendar year. (2) Gold and silver in mill bullion produced in mill of company during calendar year. (3) Gold and silver in base bullion, matte, etc. (by assay-value), produced in smelter of company during calendar year. (4) Gold and silver in crude ore and concentrates (by assay-value) shipped to custom works in calendar year.

The first item needs no explanation. The second and third items cover the cases of mining companies which have their own reduction works; they report the gold and silver bullion produced during the year, or the gold and silver contained in their metallurgical products sold to refineries, as there are very few smelting works owned by mining companies which also refine their bullion.

The greatest difficulties are found in the fourth item, comprising ores and concentrates shipped to custom works—generally smelters, more rarely mills—as a considerable interval of time, often thirty days or more, elapses before the ore reaches the works and often much more before it is reduced and refined. It is mixed with other ores and loses its identity, and the assay-value is the only guide the miner has to the quantity of metal produced. In these cases the miner is requested by the Geological Survey to give the tonnage and assay-value of ores and concentrates shipped up to the end of the year.

It should be emphasized that the table of mine production does not give the contents of the ore mined during the year. Only the ore that is treated or sold is recorded. Neither does this report give the assay-value of the total tonnage; for if this were the case the heavy losses in concentration would be disregarded, and the results would be very much larger and wholly misleading. As far as possible the report aims to give the metals recovered from the tonnage sold or treated during the year. In items 2 and 3 this is substantially correct, except for the very small refining losses. In item 4 the amount given is theoretically larger than the actual recovery of refined metals by the combined smelting and refining losses. Practically, however, this is counterbalanced by several factors: (1) Small quantities of gold and silver are recovered from many ores, but not paid for by the smelting companies or recorded in the settlements. As a rule, payments are not made on less than 2 ounces of silver or 0.05 ounces of gold per ton. (2) Settlements are made on the basis of 95 per cent of New York price for silver and of $19 to $20 per ounce of gold. Small producers, who often report in terms of dollars alone, are very likely to give a correspondingly smaller value than the ore actually contains. The same class of producers occasionally also misunderstand the questions and report net instead of gross proceeds. The gold is sometimes also given in value only, which is then always smaller than the actual value of the metal in the ore by from $0.67 to $1.67 per ounce. (3) There is always a certain small percentage of the product which can not be obtained from the miners. This includes the output of scattered individual placer workers, often aliens. There are further cases where owners of small mines decline to answer or where the property is not continuously operated and the owner cannot be found. There is, lastly, the ore abstracted by ore thieves, which takes away a notable fraction of the production of mines containing rich ore. Through assay offices this gold finds its way to the mints.

*Abstracted from 'Mineral Resources of the United States.' Advance chapter.

CALIFORNIA.

By CHARLES G. YALE.
Statistician to the United States Geological Survey.

*California produced in 1906, according to returns from the mines, 906,182.36 fine ounces of gold, valued at $18,732,452, a decrease from 1905 of $166,093. In silver the production was 1,220,641 fine ounces, equivalent to $817,830, an increase for the year of $167,821. The most marked increase was in the copper, the gain in which for 1906 was over 12,000,000 lb. in quantity and $2,939,388 in value as compared with the output of 1905. The lead shows a slight falling off, and zinc appears for the first time in the statistical tables of California.

The total tonnage of ore for the year is 2,556,053, which is 140,550 tons less than in the previous year, although there was an increase of 8914 tons in concentrates. Of silicious ores, 2,235,912 tons were treated, the average value being $8.36. Of copper ores 91,575 tons,

[We venture to add a postscript to Mr. Yale's article. The annual gold yield of the State continues to be about $18,500,000, with some show of an increase due entirely to the operation of the gold dredges. The figures given in the official statistics for the year 1906, are not likely to be materially changed for the past year, though some increase in the gold output may be looked for owing to greater yield of the dredges near Marysville and Folsom, as well as some increase from those at Oroville. The largest dredge in the State is working successfully near Folsom and is handling an immense quantity of profitable gravel. The several large machines of the Yuba Consolidated Co. above Marysville are doing wonderfully well, and the company is now producing more gold yearly than any other in the State, either quartz or gravel. These enlarged operations must necessarily exercise a marked influence on the gold output of California. Indeed, otherwise there would be a falling off in yield. The Utica, Lightner, Angels, and other productive mines in Calaveras county were closed several months during 1907 owing to labor troubles, and there is virtually over $500,000 loss in that locality. Some other quartz mines have not been so productive during the year as usual. At the same time the three largest quartz gold producers, the Kennedy of Amador county and the North Star and Empire mines of Nevada county, have been doing better than usual. Less gold will be shown from Shasta county than in 1906, as in the latter part of 1907 the copper smelting operations were restricted by reason of the low price of that metal. Less fluxing ores, carrying gold and silver, were therefore used.

No increase is to be looked for from the drift mines or from the hydraulic and placer operations. As stated, therefore, if more gold is found to have been produced than in the previous year, it is due to dredging operations. The silver output will probably be found to be somewhat less than in 1906 owing to conditions in Shasta county, which is usually the largest silver producer. Next to gold, oil is the most important of California mineral products. It is expected that when the final figures of 1907 are complete, it will be found that the oil increased in amount some six or seven million barrels. In the latter part of the year the price was almost double that of the earlier months, so the oil men have doubtless done well in 1907. As to copper, a lessened output is expected naturally from the fact that so many important mines closed their plants during the last two months of the year.—Editor.]

*Abstract 'Mineral Resources of the United States,' calendar year 1906.

PRODUCTION OF GOLD, SILVER, AND ASSOCIATED METALS IN CALIFORNIA.

	1905.		1906.	
	Quantity.	Value.	Quantity.	Value.
Gold	911,217 oz.	$18,808,545	906,182 oz.	$18,732,452
Silver	1,076,171 oz.	50,009	1,220,611 oz.	817,830
Copper	16,697,544 lb.	2,604,816	28,726,448 lb.	5,522,712
Lead	147,723 lb.	21,043	338,718 lb.	19,307
Zinc			206,000 lb.	12,566
Total		$22,174,413		$25,104,867

averaging $2.22, and of lead ores 1681 tons, averaging $7.03, were produced.

There were 27 counties in California reporting gold product from deep mines and 24 reporting output from placers of different kinds. The quartz gold amounted to $11,356,527, and that from the placers $7,375,925. Most of the deep (or quartz) gold came from silicious ores—$11,036,018, but $318,489 was recovered in the treatment of copper ores, $1020 from the lead ores, and $1000 from the zinc ores. Calaveras had the largest tonnage of ore, namely, 583,207 tons; and Amador produced the most

Map of Northern California.

concentrate—11,281 tons, yielding $850,214, which came from 577,599 tons of crude ore. In the counties along the Mother Lode, that is Amador, Calaveras, El Dorado, Mariposa, and Tuolumne, there were 131 productive deep mines and 63 placers reporting in 1906. Three of these were copper mines, two of which also produced gold and silver. There were in these five counties 1,537,761 tons of ore produced, yielding a total of $6,488,327 or an average of $4.22 per ton. The placers of these counties yielded $315,303; and the copper output was $957,984.

The quartz mining counties of the State generally did not produce as much gold in 1906 as in the previous year, while those counties in which placer mining predominates show an increase. In 1905 the quartz gold amounted to $13,006,469 and in 1906 to $11,356,527, the reduction in output of gold from this source being $1,649,942. The placer gold in 1905 was $5,892,076 and in 1906 it was $7,375,925, an increase of $1,483,849 for the year. As to gold from placer mines, the total amount for the year is $7,375,925. Of this gold, the dredges produced $5,098,359. The 246 hydraulic mines yielded $1,051,172; the 104 drift mines, $605,817; and the 260 surface placers yielded $617,577.

The importance of dredging operations in California is shown in the following table:

OUTPUT OF GOLD FROM DREDGING OPERATIONS.

County.	1905.	1906.
Butte	$2,261,888	$2,768,782
Calaveras	202,505	177,112
Sacramento	610,672	921,300
Siskiyou	7,111	26,000
Trinity	5,000	
Yuba	188,967	1,205,165
Total	$3,276,143	$5,098,359

The drift mines of the State yielded $209,423 less and the surface placers $207,978 less in 1906 than in 1905, a total of $417,401 less. But the hydraulic mines yielded $79,032 more than in the previous year and the dredges $1,822,218 more, so that the total increase from placers is $1,483,849, this increase coming mainly, as shown, from dredging.

Of the total gold output of the State the deep mines yield 64.3%. Of the total placer mining output the

dredges yield 69.1%; the hydraulic mines 14.3%; the surface placers 8.3%; and the drift mines 8.2%. This shows that the dredging operations now far exceed in yield that of the hydraulic, drift, and surface placers combined. The dredges produced $2,820,793 more gold than all the other kinds of placer mining combined. The dredges produced 27.2% of the total gold output of California.

Butte county is now for the first time the largest producer of gold in the State, the amount being $3,016,717. Nevada county, for many years the leader, produced $2,658,420. Thus the stamps of Nevada county surrender to the dredge-buckets of Butte county in supremacy of gold output for the year 1906. The largest output from hydraulic mines is from Trinity county, with $361,102; from surface placers, Placer county, $130,222; and from drift mining, Placer county, $201,076.

As to silver, the total output of the State for 1906 was $817,830, which is $167,821 more than in the previous year. Of this $506,705 was derived from copper mines, $252,151 from silicious ores, $28,082 from placer mines, $10,792 from lead ores, and $20,100 from lead-zinc ores. The increase is derived from the copper and zinc ores. The counties of Del Norte, Fresno, Inyo, Madera, Mariposa, Monterey, Nevada, Plumas, San Bernardino, San Diego, Sierra, Trinity, Tulare, and Tuolumne, show a

combined decrease of $71,196 for the year, the largest deficit being in Inyo county. Those counties showing an increase of silver are Amador, Butte, Calaveras, El Dorado, Humboldt, Kern, Mono, Orange, Placer, Riverside, Sacramento, Shasta, Siskiyou and Stanislaus, Ventura, and Yuba, the total increase being in these counties, $339,017. The largest increase is in Shasta county ($271,083), which is due to increased output of copper ore.

The mines of California in 1906 yielded 28,726,448 lb. copper valued at $5,522,712, an increase in pounds of 12,028,904, and in value of $2,917,896. The increase in Shasta was $2,648,506; in Calaveras, $384,293; in San Bernardino, $91,001; and in Amador, $109; total increase in these counties, $3,123,909. Counties showing a decrease in output of copper were El Dorado, $24,960; Fresno, $136,640; Inyo, $22,851; Mariposa, $1956; Orange and Placer, $18,691; Plumas, $166; and San Diego, $749; total, $206,013. The expansion of operations in Shasta is wholly responsible for this marked increase in copper product.

In lead there was a decrease of $9186 for the year; and an increase of $5700 in Orange and Placer counties, and $1750 in San Bernardino. The total decrease was $1736.

For the first time zinc was produced in California, the value of the output having been $12,566.

It is to be noted that while the gold output of California declined in value in the small sum of $166,093, and the lead $1736, the silver increased $167,821, the copper $2,917,896, and the zinc $12,566, a total of $3,098,283. This makes the total output of California in all these metals $25,104,867 for the year 1906, which is an increase over the previous year (with platinum omitted in both years) of $2,930,454. For this increase in value, it will be noted, copper is mainly responsible.

PRODUCTION OF LEADING COUNTIES.

AMADOR, which is on the Mother Lode, shows a reduction of $158,035 for the year. The falling off in gold output was $159,785, but there was a small increase in silver and copper. The following statement shows the output for the past two years:

Year.	Gold.	Silver.	Copper.	Total.
1905	$2,420,161	$12,938	$1,560	$2,434,65
1906	2,260,376	14,579	1,669	2,276,62

Twelve deep mines report product, and some of these are being worked at great depth. The vertical shaft of the Kennedy is 3100 ft. deep; the Argonaut is 2700 ft. on the incline; and the shafts of the Central and South Eureka mines are 2500 ft. on the incline. The milling capacity of the county is 420 stamps. The principal producing mines are the Bunker Hill and Keystone at Amador City; Fremont Consolidated (Gover) at Drytown; Argonaut, Kennedy, Oneida, and Zeila at Jackson; and Central and South Eureka at Sutter Creek. The Oneida at Jackson has been given up and will no longer be worked. The Wildman and Mahoney mines at Sutter Creek have made no yield of late, not having been worked. The 579,569 tons of ore milled yielded $2,230,620 in gold and $14,401 in silver. The concentrate from this ore yielded $844,024 gold and $6190 silver from 11,281 tons.

BUTTE shows an increase of $435,861 gold and $4,265 silver. The total yield of the county was $3,016,747 gold and $10,853 silver. Butte is now the leading gold producing county of the State. This is entirely due to the operation of the dredges at Oroville. The quartz mining industry of the county is now of small importance, only 682 tons of ore having been worked in 1906, with a total yield of $6721. These quartz mines are at Berry Creek and Lumpkin, and are all small ones. Placers of different kinds are being worked at Bangor, Berdan, Berry Creek, Brush Creek, Cherokee, Clipper Mills, Enterprise, Forbestown, Inskip, Lumpkin, Orloff, Megalia, Nimshew, Oroville, Pentz, West Branch, and Yankee Hill. There are 56 producing placers, including 5 hydraulic mines 12 drift mines, 24 surface placers, and 15 dredging companies. The hydraulic mines in this county yielded $37,220 gold, drift mines $102,908, surface placers $101,207, and dredges $2,768,782.

The following table shows the output of gold from dredging operations at Oroville in the past few years, and the annual increase:

Year.	Yield.	Increase.
1903	$1,329,998	
1904	1,632,507	$302,509
1905	2,261,887	629,380
1906	2,768,782	506,895
Total	$7,993,174	$1,438,784

The number of dredges is increasing at Oroville, but other parts of the State are also showing profitable dredging areas. Most of the dredges are now landlocked, that is, none of the tailing material is allowed to escape into the rivers, but is impounded or enclosed with walls of cobbles and rock thrown up by the stackers.

CALAVERAS shows a falling off of $136,251 in its gold output for the year, but the copper has increased by $384,293, and the silver by $10,261, a total increase of $258,303, as the following table shows:

Year.	Gold.	Silver.	Copper.	Total.
1905	$1,780,185	$63,838	$572,022	$2,416,345
1906	1,644,234	74,099	956,315	2,674,648

The copper output is rapidly increasing. Over two-thirds of the copper came from Campo Seco and the balance from Copperopolis. Nearly 45,000 tons of ore were smelted in 1906. This copper ore yielded $59,294 in gold, and $65,138 in silver. These mines have their own smelting plants at the properties. The silicious ore from the quartz mines amounted for the year to 538,566 tons, yielding $887,918 gold, and $4971 silver. There were 32 deep quartz mines producing this ore. The increase in tonnage in the county for the year was 35,235 tons, including copper ore. Of concentrate there was 10,039 tons, yielding $473,295. Calaveras had the largest tonnage of any county in the State in 1906, the amount being 583,207 tons of ore.

The principal producing quartz mines are the Angels Quartz, Lightner, and Utica at Angels; the Gwin at Gwin mine; the Melones at Melones; and the Sheep Ranch at Sheep Ranch. Most of the other quartz mines were comparatively small producers. The copper properties are the Penn Chemical Works at Campo Seco and the Union Copper Co. at Copperopolis. There are 478 stamps operating in the mills of the county. The placer yield of Calaveras was $227,017, the larger proportion of which was from dredging operations at Jenny Lind and Wallace. There is very little surface placering, but the hydraulic and drift mines are productive, there being 14 placers in all, including two dredge enterprises.

NEVADA has been the leading gold-producing county of California for many years, but in 1906 its gold output was exceeded by that of Butte. It is still, however, the leading producer of gold from quartz mines. The production for the past two years was as follows:

Year.	Gold.	Silver.	Total.
1905	$3,076,997	$24,842	$3,101,839
1906	2,658,420	24,219	2,682,639

Fifty-six mines reported product in this county, 32 quartz and 24 placers. Of the latter the 7 hydraulic mines yielded in gold $117,724; the 8 drift mines, $135,182, and the 9 surface placers, $11,105, a total of

$264,011 from gravel. The ores treated were all from gold mines and amounted to 276,602 tons, which is 48,664 tons less than reported the previous year. From this ore were derived 4,912 tons of concentrate, which yielded $284,759. The total quartz gold, including this, was $2,394,409 and the total quartz silver $22,805. This shows that the average value of the ore milled in the county was $8.74 per ton.

The most productive quartz mines in the State are in the Grass Valley district, in which are included both Grass Valley and Nevada City. The returns for the past two years from the quartz mines were as follows:

	—Grass Valley.—		—Nevada City.—	
Year.	Gold.	Silver.	Gold.	Silver.
1905	$2,041,447	$10,483	$440,236	$12,531
1906	2,196,990	16,516	133,031	5,755

Aside from the reduction in output of the gravel mines of the county, this table shows that the decrease in yield of gold for the year was largely in the mines around Nevada City. The two largest mines at that point were inactive during 1906 owing to litigation, but lately operations have been resumed. The most productive gold quartz mine in the county—and in the State—is the North Star at Grass Valley. Other productive mines at that place are the Brunswick, Bullion, Central, Empire, Sultana, Idaho-Maryland, Pennsylvania, New York-Grass Valley, and Spring Hill. At Nevada City the producers are the Glencoe & Freeman, Gold Flat, Home Gold, Murchie, and Pittsburg.

At Graniteville are a few small producers, and others are at North Columbia, Rough and Ready, and Washington.

The largest producers among the auriferous gravel mines are the Esperance drift mine at French Corral; Liberty Hill hydraulic at Lowel Hill; Blue Tent at Nevada City; North Bloomfield and Union Blue at North Bloomfield; Waukeshaw at Relief; Badger Hill or Cherokee, Kate Hayes, Eureka Lake, and Yuba Canal at North San Juan; and Omega at Washington.

SHASTA shows the remarkable increase of $3,031,995, due to the resumption of active operations of the Mountain Copper Co., and the enlarged output of the Mammoth and other copper enterprises in the county. The record of the past two years is as follows:

Year.	Gold.	Silver.	Copper.	Total.
1905	$706,738	$163,400	$1,689,615	$2,559,753
1906	819,141	434,483	4,338,121	5,591,748

The county is thus by far the largest producer in the State, considering the gold, silver, and copper combined. It illustrates the importance of copper mining as a productive industry. Of the 30 deep mines producing gold in the county, 17 are deep gold mines, 9 placers, and their combined output is $819,144, yet the value of the copper from the four mines of that metal exceeds the gold by $3,518,977, which figure, in itself, is larger than the entire mineral output of any other county in the State.

The entire tonnage of the county was 327,482 tons, yielding a total of $5,591,748. Of this 22,897 tons of ore were milled, yielding $277,705 gold and $2195 silver. In this ore were 152 tons of concentrate, which yielded gold $12,871 and silver $217. The output from milling ores was $290,579 gold and $2412 silver, a total of $292,991. From 304,585 tons of smelting ores, the output was $518,705 gold, $132,009 silver, besides the copper. The copper ore amounted to 262,388 tons, yielding $1,338,121 in that metal, aside from the gold and silver. The quartz and smelting ores produced a grand total in gold, silver, and copper of $5,581,826. The placers in the county only yielded $9860 gold and $62 silver, a total of $9922.

It should be understood that large quantities of siliceous ore, carrying gold and silver, are used as flux in the copper smelting furnaces. In fact, one reason for the prosperous condition of the gold quartz mining industry in Shasta is because so many miners are working properties on which they do not have to erect reduction works, but sell the ore direct to the copper smelting companies, receiving returns in proportion to the assay-value. These smelting companies also obtain some ore from adjoining counties, and of late, have made purchases in southern Oregon.

The most productive copper mining enterprise in the county at present is the Mammoth Copper Mining Co., with smelters at Kennett. Other large copper producers are the Mountain Copper, with smelters at Keswick, in Shasta county, and Bulls Head Point, in Contra Costa county; the Great Western Co., with a smelter at Ingot; and the Bully Hill Co., with a smelter at Winthrop. The prominent producers of quartz gold are the National, the Original Quartz Hill, and the Utah & California at Buckeye; the Hazel (Gladstone), Brunswick, and Black Tom (Niagara) at French Gulch; the Midas at Knob; the Gambrinus and Mad Ox at Stella; and the Evening Star and the Reid at Whitehouse. Outside of the copper companies, the largest producer in the county is the Hazel Mining Co. at French Gulch. The increase in tonnage in this county (113,446 tons) is the largest of any county in the State.

TRINITY shows a falling off in its gold product of $215,192 as compared with the year 1905, and there was also a small reduction in its silver output. This is a county where mining for auriferous gravels is the predominating industry. Of the gold output of $560,843, the sum of $413,679 came from placer operations, while the quartz gold was only $147,164. The gravel mines, therefore, yielded $266,515 more gold than the quartz properties. There are 67 gravel mines reporting product, of these 41 are hydraulic mines, which yielded $361,102 in gold; 2 drift mines, yielding $2000; and 21 surface placers, with an output of $50,577. As regards hydraulic mining, Trinity has the largest output of any county in the State. Its 41 mines of this character yielded over $100,000 more than the 100 hydraulic mines of Siskiyou, which comes next in rank in this class of mining. In these two counties there are no restrictions upon hydraulic mining as there are in the counties in the drainage basin of the Sacramento and San Joaquin rivers, where the tailings have to be impounded. The most productive and largest hydraulic mine in the State is the La Grange, near Weaverville. Other large hydraulic mines are the Hupp at Weaverville; and the combined Chinese mines at the same place; the Bennett at Douglas City; the Sykes at Trinity Center; Chapman & Fisher at Junction City, and the Burger at the same place; the Butler (Old Unity) at Minersville, and combined Chinese mines at the same place. All these mentioned made an output of over $10,000 in 1906.

The yield of silver from these gravel mines was only $1731, and the yield of silver from the quartz mines of the county was $1250. There are no large quartz mining operations in the county and the yield from this source appears to be falling off. The tonnage for the year 1906 was only 9261, a falling off of 31,207 tons for the year. It was all silicious ore; about 300 tons of concentrate was worked. The principal quartz mines are the Five Pines at Trinity Center; the Brown Bear at Deadwood; the Globe at Dedrick; the Bullychoop near the Shasta line; the Oro Grande at Carrville. Other smaller quartz operations are conducted at these points and at Coleridge, Denny, Dorleska, Douglas City, and Lewiston. No copper is yet being produced in the county, but several mines of this metal are being opened or developed.

NEVADA.

By CHARLES G. YALE.
Statistician to the United States Geological Survey.

*As the total value of the gold, silver, and associated metals produced in Nevada in the calendar year 1905 amounted to $9,453,114, and in 1906 to $15,714,442, it will be seen that the State showed the very marked increase for the year of $6,261,328. Moreover, there was a decided gain in the value of every one of the metals, the most notable, as was to have been expected, in the gold, namely, $5,200,885. The silver increase was considerably over half a million dollars, and the copper about a quarter of a million dollars, and both lead and zinc show satisfactory advances.

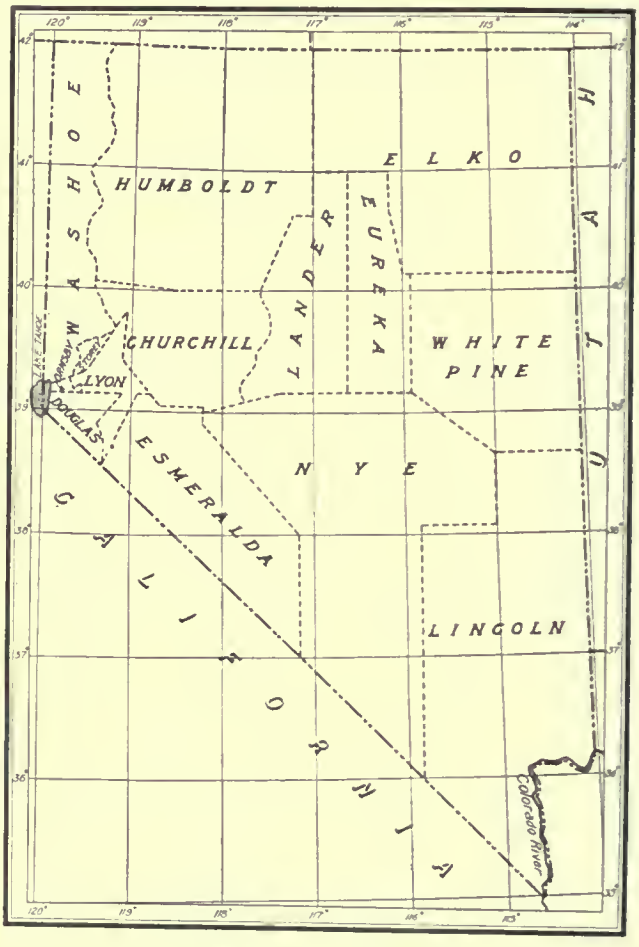
Although Nye county was much the largest producer in the State in 1905, and increased its output in 1906 by $685,620, yet it now takes second rank, giving the first place to Esmeralda, which has a total output for the year of $7,295,543. Of this $7,125,119 is gold, and of this total the amount of $7,026,154 came from Goldfield alone, which also yielded $10,484 in silver. The increase in production of this camp over the previous year was $5,148,499. The increase at Tonopah, in Nye county, was $672,803. The only other county of the State with a record for the year of over a million dollars is Lincoln, which yielded $1,506,056.

It may be proper to note that while the figures quoted show a very marked and satisfactory increase in bullion production, and indicates material progress in the condition of the mineral industry of the State, it is doubtful if they will be acceptable to many engaged in mining stock transactions who have led the public to believe that millions of dollars are coming monthly from the mines in the newer camps. To those engaged in legitimate mining enterprises, however, who know the time required to bring even the best of mines to the stage of development when steady and regular production may be expected, the showing is most satisfactory. The grade of ore yielded by certain of the mines of the State has been remarkably high, considering the quantities shipped, and as these shipments have been published when the ore was hoisted and sacked, again when actually shipped, and still again when returns were received, exaggerated ideas as to the weekly and total output of certain prominent mines prevail generally. Nevada has doubtless attracted more attention from miners, prospectors, and investors during the past few years than any of the other mineral-producing States of the Union. That it has 'made good' may be admitted; and it may also be taken for granted that everything indicates a still further and more marked increase in output as other mines are brought to a productive stage, and other camps are developed.

Nevada has two decided advantages from a mining point of view. It really has numerous mines of merit, and what is about of equal importance it has plenty of capital ready to develop them. After a long period of depression in mining affairs, and a gradually decreasing yield, the discoveries in the southern portion of the State a few years ago, once more attracted general attention to the possibilities of the mineral region. These camps were very rapidly developed, permanent towns established, railroads built, and a large population settled in what was heretofore desert territory. A natural result of these changed conditions was the revival of older camps, and their rehabilitation. Many of the old centres of mining, prosperous a quarter of a century ago, had been virtually abandoned and the mines closed. Lack of capital, and of suitable means of ore reduction and transportation brought about this result. As the success of the newer camps became manifest, population increased and capital for investment became plentiful. Then men began to investigate properties in the older camps of the State where there were numerous partly developed mines lying idle. Nearly all of these older localities are now being exploited to a greater or less degree. Moreover, not only are silver and gold being sought, but it is found that Nevada is rich in copper, zinc, and other metals, and mines of this character are being sought for, developed, and equipped.

Of course, the newer localities where the mines proved rich, and afforded opportunities for prospecting, mining, and investment in a virgin tract of country, naturally won the most attention. And it is from those new camps that the bulk of the bullion production of the State is now being derived and whence the most material increase of the future is to be expected.

In exemplification of this, it may be stated that over 77% of the entire bullion output of the State in 1906 came



The Counties of Nevada.

from the two camps of Goldfield and Tonopah; and that Goldfield alone produced nearly 45% of the total yield. This statement shows clearly the importance of the new camps, and it shows also why these two camps have had such an influence in bringing population and capital to the State. Much of the money derived from the new mines is being invested in developing properties at other points in Nevada, and outside capital is doing its shar also.

While more or less leasing is still going on, the larger productive mines are now worked solely on owner's account, the leases having expired, and not having been renewed. In this connection it is proper to make some mention of the so-called 'high-grading' in the mines that carry the richest ore at Goldfield. In the opinion of the officials of the most prominent mines, the ore stolen by the 'high-graders' amounted in 1906 to $1,250,000, of

*Abstracted from 'The Mineral Resources of the United States.' *lendar year 1906

which about $250,000 was ultimately recovered. This leaves a million dollars worth of ore presumably still secreted and as yet unmarketed. Of course, this amount is not included in the statistical tables.

Aside from Goldfield and Tonopah most of the newer camps of the State were only small shippers in 1906, although much development was accomplished. Some mines that were in a position to ship ore were awaiting the completion of railway lines; while others were holding their ore until in a position to mill it themselves. The San Pedro, Los Angeles & Salt Lake railroad is now completed from Las Vegas, in Lincoln county, to Bullfrog, in Nye county, and will open up a large mineral region. The Western Pacific line will also soon be completed in the western part of Nevada and will put many properties in White Pine county on a shipping basis. The completion of the Nevada Northern railroad from the main line of the Southern Pacific to Ely has already proved of the greatest advantage to the many low-grade copper properties being developed in that vicinity.

There is also some indication of the Nevada Central railroad, which runs from Battle Mountain to the old camp of Austin, being extended south through the Reese River district to the Round Mountain and Manhattan districts, in the northern portion of Nye county. The developments at Fairview and Wonder would also seem to warrant the construction of a branch railroad from Hazen, on the Southern Pacific, to these camps. The completion of the Tonopah & Tidewater railroad will give a second outlet to the camps in southwestern Nye and Esmeralda counties.

Although there were only 143 deep mines reporting product in the State in 1906, they yielded 496,307 tons of ore. The dry or silicious ores amounted to 163,672 tons (an increase of 42,268 tons), of an average value of $32.37 per ton. The 5,184 tons of copper ore averaged $5.84 per ton in gold and silver; and the 18,940 tons of lead ore averaged $13.51 per ton in gold and silver. There were also 8,511 tons of zinc-lead ore worked. Altogether the increase in tonnage for the year is 64,105. The amount of concentrate produced was 1,395 tons, worth $440,375. In addition there were 67,387 tons of old tailing worked, yielding $170,995. These were nearly all from the Comstock.

In 1906 there were 155 producing mines in Nevada, 143 deep and 12 placers. Two of the latter are hydraulic and the others surface placers. Of the deep mines, 75 have gold as the principal metal, 34 silver, 6 copper, 26 lead, and 2 zinc-lead. There have also been received reports from 1,070 non-producing mines. Of these, Nye county has the most—271, followed by Esmeralda with 193, Lincoln with 171, and the other counties with smaller numbers.

Furthermore, Eureka county produced 1,014,244 lb. of lead, worth $57,712, and Lincoln 948,830 lb., worth $52,088, the entire State yielding 3,823,617 lb. of lead, worth $217,549. In zinc the total output was 2,886,328 lb., worth $176,066, nearly all of which came from Lincoln county.

As to the source of the gold produced, with the exception of 2,556 oz. from placers, 127 oz. from copper ores, and 31,160 oz. from lead ores, it was all extracted from silicious ores. By far the largest part was derived from the mines at Goldfield. As regards the silver, the placers yielded 1,296 oz.; copper ores gave 11,273 oz.; lead ores, 275,469 oz.; and zinc-lead ores, 391 oz. This leaves 6,452,182 oz. as having been extracted from silicious ores. Of the total amount of silver 5,739,852 oz. came from Nye county, mainly from the mines at Tonopah.

The producers at Goldfield in 1906 were the Combination Fraction, Florence, Gold Bar, Goldfield C. O. D., Goldfield Daisy Syndicate, Goldfield Consolidated (Mohawk, Jumbo, Combination), Goldfield Great Bend, Jumbo Extension, and Diamondfield Black Butte Consolidated. By far the largest part of the output was from the various mines of the Goldfield Consolidated Mines Co. In this district the output for the year was 59,628 tons of ore, which, on being treated, yielded $7,036,638, of which $10,484 was silver and the rest gold. Much high-grade ore was shipped, but the average value of the total amount treated was $118 per ton, of which $117.83 was gold and 17 cents silver. At the local mills 19,461 tons of ore were worked, and to the smelters 40,167 tons were shipped. The milling capacity of the camp will be much larger in 1907. It may be said generally that the camp is in a position largely to increase its output and will do so for some time to come.

PRODUCTION OF METALS IN NEVADA IN 1905 AND 1906.

	1905.		1906.	
	Quantity.	Value.	Quantity.	Value.
Gold, oz.	254,927	$5,269,819	506,520	$10,470,704
Silver, oz.	6,482,081	3,915,177	6,770,611	4,536,310
Copper, lb.	413,235	64,465	1,625,985	313,813
Lead, lb.	3,457,124	162,485	3,823,617	217,549
Zinc, lb.	697,757	41,168	2,886,328	176,066
Total		$9,453,114		$15,714,442

PRODUCTION OF GOLD, SILVER, AND COPPER IN NEVADA IN 1906.

County.	Gold.		Silver.		Copper.	
	Oz.	Value.	Oz.	Value.	Lb.	Value.
Churchill and Douglas	1,719	$36,171	192,138	$128,733		
Elko	8,497	175,653	43,854	29,382		
Esmeralda	344,677	7,125,119	141,975	95,123	180,000	$34,740
Eureka	2,362	50,911	77,552	51,960	6,653	1,283
Humboldt	774	16,010	9,030	6,050	518	100
Lander	538	11,127	86,564	57,998	3,404	657
Lincoln	54,561	1,127,886	73,869	49,512	521,043	100,560
Lyon	2,375	49,112	68,027	45,578	888,993	167,716
Nye	71,824	1,484,749	5,739,852	3,845,701		
Storey	15,855	327,760	277,258	185,763		
Washoe	1,453	30,038	8,958	6,002		
White Pine	1,748	36,152	51,503	34,508	45,374	8,757
Total	506,520	$10,470,704	6,770,611	$4,536,310	1,625,985	$313,813

In Lincoln county, production is reported from the districts of Crescent, Ferguson, Eagle Valley, Pioche, Yellow Pine, and Searchlight. The largest and most important producers in the county, and one of the largest producers of gold in the State, is the Bamberger Delamar Mining Co., in the Ferguson district. In output of gold only two properties exceed it, those of the Goldfield Consolidated Mines and the Tonopah Mining Co. It handles, however, very much the largest tonnage of any property in the State, and the ore is crushed and cyanided at its own plant. Aside from Ferguson, the most productive district in the county is Searchlight, which yielded $519,785 in gold and $7,734 in silver. The companies making this production were the Cyrus Noble, Brockman (Duplex mine), Quartette, Southern Nevada, and Searchlight companies. Of the 15,668 tons of ore worked in the district in 1906, the Quartette company produced 23,346. Four of these companies have 10-stamp-mills, while the Quartette had a 20-stamp mill and 20 stamps were added in 1907. The shaft on this mine is 850 ft. deep, while the shafts of the others run from 250 to 500 ft. in depth.

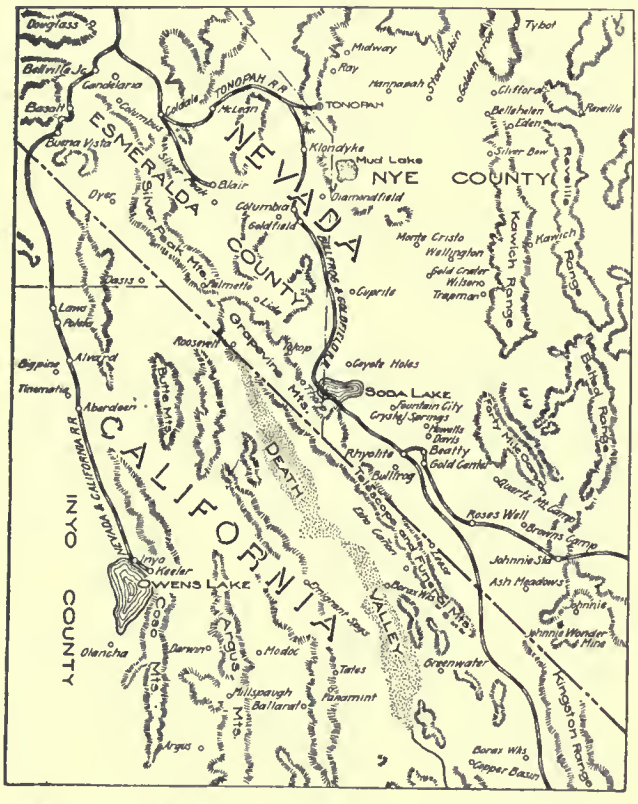
The Clark railroad has given new life to the old district of Pioche and to Yellow Pine. The only prominent producer in Pioche was the Bristol Consolidated Copper Co., which shipped a large tonnage of ore carrying silver, copper, and lead. The principal producer in the Yellow Pine district was the Potosi Zinc-Lead Co., which is the largest producer of zinc in the State.

The principal district in Nye county is Tonopah, which is second only to Goldfield, in Esmeralda county. The producers at Tonopah in 1906 were the Jim Butler, MacNamara, Montana Tonopah, Tonopah North Star, Tono

pah Belmont, Tonopah Extension, Tonopah Midway, Tonopah, and West End Consolidated companies.

The amount of ore treated from this camp in 1906 was 106,491 tons, yielding in gold $1,304,677 and in silver $3,817,612. This shows the average value to be $48.10, of which $35.85 is silver and $12.25 gold. All the ore from the camp in 1906 was shipped to smelters except that portion sent by the Tonopah Mining Co. to Chas. Butters & Co. at Virginia City for cyanide treatment. Over two-thirds of the silver output of the State came from Tonopah. The tonnage would have been greater had the companies been able to get sufficient cars, but the railroad was crowded beyond its capacity.

Shipments of ore from Bullfrog were comparatively small in 1906. Those reporting production were the Montgomery Shoshone, Skookum Bullfrog, Gibraltar Consolidated, and Tramps Consolidated companies. The



Map of the New Mining Districts of Nevada and California.

Berlin mine in Union district had a smaller output than usual. The new district at Fairplay had many active mines, but the only shippers were the Griggs Attwood, Attwood, and Pactolus companies.

The mines of the Comstock in Storey county yielded only $327,766 in gold and $185,763 in silver from 15 different mines.

The production of Nevada in 1907 is estimated at $15,000,000 of gold and 6,000,000 oz. silver.

ELECTRICAL POWER IN ARIZONA.—The successful organization of the Arizona Power Co. of Prescott, Arizona, is announced by R. S. Masson, associated with F. S. Viele, of New York. Immediate construction of the first power-generating plant will begin on Fossil creek, where 7500 hp. will be generated to supply the power and lighting contracts already made with the United Verde mine and the Humboldt smelter. The transmission lines of this company will pass through the centre of that extensive mining territory between Jerome and the Bradshaw mountains, and enough power will eventually be transmitted to supply all the mines and mills in this region. The Electrical Operating & Construction Co. will superintend the building of the different power plants.

ALASKA.

A. H. Brooks, chief of the United States Geological Survey's division of Alaskan mineral resources, has just returned from Alaska, and reports that various unfortunate conditions have led to such a curtailment of gold mining in Alaska during the last summer as to result in a material reduction in the gold output as compared with that of the previous year. Accurate statistics will not be available for several months, but the preliminary estimates indicate that the value of Alaska's entire gold production for 1907 will be between $17,000,000 and $18,000,000, as against more than $21,000,000 last year. This loss must be charged for the most part to the decrease in the production of the placer mines.

It is not to be supposed, however, that Alaska's placers have passed the zenith of their production. All the evidence points to the conclusion that a greater annual production than that of 1907 will yet be attained. The mining industry has therefore received only a temporary setback, but it is one from which it may not recover in less than a year or two. Mr. Brooks says:

The curtailment of placer operations can be assigned to certain definite causes, of which the difficulty of obtaining adequate labor is the most important. The Fairbanks district is the one that suffered most from labor troubles. A strike was started there on April 27, just when the gravel accumulated by the winter mining operations was ready to be sluiced by use of the water of the spring freshets. As a result many of the winter dumps were not finally washed out until fall. This not only prevented the mine operators from continuing work, but also put many of the smaller operators into financial difficulties, because they had counted on the winter production to finance the work during the summer. Labor conditions in the camp gradually adjusted themselves during the summer, but throughout the open season there was lack of experienced miners. When the strike began about 1200 men, it is said, left Fairbanks, most of whom started for the newly discovered Innoko district. As a result very few new enterprises were begun, and many of the established mines were not operated during the summer. Had there been laborers enough the Fairbanks district would, no doubt, have produced more gold in 1907 than it did in 1906. As a matter of fact its production was probably $3,000,000 less than it was in the previous summer.

Among last summer's important developments were the noteworthy production of Esther creek, the opening up of considerable placer ground on Vault creek, and the discovery of prospects on Eldorado and Our creeks. These discoveries, together with those on Smallwood creek, indicate that the Fairbanks district proper is more extensive than had been previously supposed. The finding of gold in an adjacent area, on the upper Chena river, is also significant, as this region appears to lie in the same general belt as the Fairbanks district.

The railroad from Fairbanks has now been extended to the mouth of Cleary creek, and this road and the numerous wagon roads that have been built make all parts of the district accessible. The high charges on freight from Puget Sound ports and the uncertainties and delays in its delivery still greatly discourage all mining enterprises. These discouragements can be removed only by the establishment of railroad communication with some coastal point.

Important developments were made in the Rampart district, notably in its southern part, on the tributaries of Baker creek, where two ditches were built and some successful hydraulic operations were carried on. Noteworthy, too, is the installation of three dredges in the Fortymile

district. Two of these were in operation for a part of the season.

Some excitement was caused by the discovery of placer gold at several points on the lower Yukon. While no great values were found, yet these localities are so accessible that they give promise of being mined at relatively low cost. The two largest stampedes of the season took place to the Chandlar river and to the Innoko. In the first locality at least one producing creek was developed and some good prospects were found at other localities. Of the Innoko less definite information is available. More than a thousand people took part in this stampede, and many claims were staked, but little systematic prospecting was done. The region is rather difficult of access, being several hundred miles from the Yukon by the Innoko river route. Some gold has been found, but it is too soon to predict what the future of this camp will be.

Seward Peninsula also had its labor troubles during the past summer. Though they were not so serious as those of Fairbanks, yet they considerably hampered mine operators, and as a consequence the production will probably be less than it was last season. The old beach-lines continued to be the centre of mining activity, though much of their extent has now been mined out. The second beach-line has been traced east of Nome river to Cunningham and Hastings creeks. The third beach-line has also been traced to Hastings and has been found west of Snake river at Sunset creek. There can be no doubt that the discovery of these rich beach placers has retarded the development of more extensive but less valuable creek and tundra placers. These ancient sea beaches have proved to be so very rich that mine operators are disinclined to spend their activities in preparing to work the lower grade deposits of other forms of placers. As a consequence, there has been but relatively little creek mining during the last two years in Seward Peninsula, especially in the vicinity of Nome.

In the northeastern part of the peninsula two long ditches, one at Candle creek and one discharging on the Keewalik, were completed. Considerable mining was done in this part of the peninsula, notably on Candle creek. The Taylor creek and some smaller ditches in the Kugruk district were also completed and were in part in operation.

The dredge on Solomon river has been in operation throughout the summer, as has also one near the mouth of Ophir creek. A smaller dredge has been operated on West creek, and a large dredge was constructed for mining on Bourbon creek near Nome. Gold dredging will undoubtedly become important in the peninsula. Plans are under way for utilizing water power and reducing the cost of operating the dredges.

Additional attention has been given to lode prospecting during the past summer, especially in the Nome district. Copper, lead, bismuth, antimony, and gold ores have been found, but it is too soon to predict an important future for lode mining.

In the Cook Inlet region the most notable developments were in the Yentna district, discovered in 1905. Here the operators are for the most part small holders, but in the aggregate considerable gold was produced. Work continued in the placers of the Sunrise district, but there were no noteworthy developments. Interest was aroused by the discovery of mineral-bearing lodes in Kenai Peninsula and in the islands and mainland to the southwest. Whether any of these are of commercial importance remains for the future to decide.

The mining of copper ore was continued at several localities in the Prince William Sound district, and considerable prospecting for copper was done. There was great activity in the Copper River region, especially in the Chitina copper belt. This region has been rendered more accessible by placing a steamboat on Copper river, above the rapids. The operations in this copper belt have been confined chiefly to making surveys for patents and to doing assessment work. It will be impossible to carry on any great amount of mining until the region is made more accessible by the railway.

The railroad situation in this part of Alaska has been the focal point of public interest throughout the summer. Construction work has been actively pushed by two companies building from Katalla, the immediate objective point being the coal deposit lying about 25 miles inland. In midsummer construction was also begun on a railroad from Valdez. All three of these roads claim to be building into the copper belt of the Chitina region.

Little has been done in the Alaska coalfields except to make surveys with a view of obtaining title to coal lands. The Controller Bay field will be opened up as soon as railroad transportation is established, and the same may be said of the Matanuska field.

In southeastern Alaska labor conditions again have trammeled mining operations. The Treadwell mine was closed for about three weeks early in the summer because of a strike, and the small operators have been affected to a lesser degree.

The copper mines of the Ketchikan district, which were being actively developed early in the summer, seriously felt the fall in the price of copper and some of them were forced to close. This was the case with the Hadley smelter and its subsidiary mining properties. Early in the summer five mines were shipping copper ore and a number of other properties were being opened.

FARADAY'S MIND was too absorbed in wonderment and almost religious fervor, as the secrets of nature revealed themselves, for sordidness in any form to find lodgment. He wasted his energy neither in money-making nor in captiously defending his discoveries and great conceptions from supposed infringement by other scholars. He never forgot, despite his brilliant original work, that generally the great investigators only lay the keystone in the arch which many less gifted workers have been erecting stone by stone. He did not consider it any detraction from his honor that he was permitted only to crown the structure which others had helped to build from the foundation up. They are the greatest among the great who appreciate this limitation and recognize what they owe to others. Faraday knew that his discoveries gave him but imperfect glimpses of some of the laws and phenomena of nature, which we, through our ignorance and prejudice, are slow in understanding, but which would soon cease to be secrets if we could only disabuse our minds of false conceptions, see facts as facts instead of as arguments for our theories, and then work together with single-heartedness.—James Douglas.

GOLD IN FRANCE.—Wells bored in Meurthe et Moselle have shown the presence of a notable quantity of gold and silver at a depth of about 800 ft. Some samples brought up with the cores have yielded 6 gm. of silver and 1 of gold per ton of mineral. These were taken from sandstones of Triassic age. From another boring, made by Mr. Francis Lour, during his interesting investigations in the Muschelkalk, at 1800 ft., beds of calcareous sandstone were met with which proved superior in yield to the average Transvaal gold-bearing rocks—that is, gave more than 8 gm. of the precious metal per ton. Further, considering that the mineral during calcination loses about one-fourth of its weight, it can be asserted that some specimens were worth at least £6 per ton. The gold is thought to have originated through the evaporation to dryness of the ancient Triassic sea.

Variations in Mining Costs.

Written for the MINING AND SCIENTIFIC PRESS
By J. R. FINLAY.

In examining a mine in southern Idaho I found that expectations were being based on a mining cost of $5 per ton. Upon studying the question to the best of my ability, I concluded that the ore could not be mined for less than from $20 to $25 per ton. This enormous discrepancy of course influenced decisively the transaction contemplated and laid emphasis on the importance of correct knowledge on this point. There were no figures at hand showing the experience of former operators. The aggregate value of the ore blocked out was about $1,000,000. I think it will prove interesting to analyze the considerations which gave rise to such a wide difference of opinion. One of the most vital features proved to be the question of the necessity and cost of development work.

It was assumed on one hand that advantage could be taken of the ore already available, and it was thought without any great attention being paid to the subject that a cost of $5 per ton would be ample for mere stoping. It was thought that the property could be paid for out of the ore reserves and, that object being attained, the development could safely be left to take care of itself, since any further ore would represent clear profit. In certain contingencies this view of the matter might be all right. If the development had proceeded to a point where it demonstrated that no further ore should be looked for, of course the only problem to consider would be to extract the ore in reserve as cheaply as possible.

This was not the case. The prospect of finding more ore was good and the profit to be made from the property depended on future discoveries. At the contemplated cost of $5 per ton for mining the profits to be expected would no more than cover the price of the property. If when the ore was exhausted the property were nominally paid for, it would be rather a vain triumph. In that event two unpleasant necessities would have to be faced:

(1) Shutting off production until more ore could be developed.

(2) Finding money for the development.

Under such circumstances the paying for the mine from o e reserves would indeed only be nominal. The correct stand to take was that the property must be considered as a permanent thing. Development must be provided for from the beginning. The mine could not be considered as profitable unless the ore already available could not only pay for stoping, but for finding more ore and for a number of other things that cost money.

The whole problem is a function of how the ore occurs in the ground and of the commercial conditions of the neighborhood in which it is situated. The occurrence of the ore was as follows: The veins were exceedingly persistent both in length and depth, but the ore-shoots would average only nine inches thick. The shoots moreover were short, of irregular outline, and were scattered along the vein for a length of about 2000 ft. As greater depth was attained, the vein itself must be reached by longer and longer adit-levels. On account of the vein consisting of a system of nearly parallel fissures, any one of which might be mineralized, it was necessary to crosscut a zone and in many cases run parallel drifts on the same level. Moreover, for purposes of ventilation as well as for exploration, raises had to be put up at intervals. In fact, not less than 15,000 ft. of openings had been made during the history of the mine to find and open up about 25,000 tons of ore. Just what this development cost I do not know, but it would probably average $12 per foot, or $180,000. Here we have a cost of, in round numbers, $7 per ton for finding the ore and getting it ready to stope.

It is pretty evident from the above that even were the estimated stoping cost of $5 per ton found to be correct, our real mining cost would be $12 per ton, adding the development.

But as a matter of fact a nine-inch seam cannot be stoped for $5 per ton in Idaho. It is to be remembered that the nine inches of ore must be kept carefully separated from the waste. When it is remembered that a stope can scarcely be worked that will not average at least 3½ ft. wide, it is evident that about four times, by weight, as much material must be handled as is taken out as ore. Moreover, the necessity of keeping the ore strictly separated from the waste makes it necessary to perform two separate acts in breaking and removing the ore and waste. It is probable that if all the material in a 3½-ft. stope were removed, the cost would be about $3.50 per ton, but when only one quarter of this material is ore, the cost of the ore will be $14 per ton. In my judgment, therefore, the mining of this material would stand thus far as follows:

Development	$ 7 per ton
Stoping	14 " "
Total	$21 " "

But even at this we have not in all probability arrived at the true mining cost. We have considered development and stoping costs as fully and properly worked out. I mean by this that we have not deceived ourselves by poor accounting, forgetting to add in the manager's salary or the office expenses. We have charged up every current expense against the operation. But what about expenses that are not current? I mean the amortization of the plant.

In this connection I think we should not charge the purchase price of the property. That price might be entirely out of proportion to its merits. I am trying to arrive at the real operating cost, which, of course, includes all expenditures made necessary in the process of working the mine. Machinery, offices, tramways, warehouses must be provided, and the cost of all these things must be returned with interest. It is quite easy to forget this fact in preparing a statement of stoping costs. It *is* forgotten, I believe, in 99 cases out of 100. In saying this I do not wish to convey the impression that so large a proportion of examining engineers overlook this point; but I do mean that as costs are generally discussed and figured by mining men, no heed is paid to anything except the current expenses.

The way to gain a correct idea of the usual confusion between part costs and real costs is to get the history of a number of mines for periods long enough to give a true average of results and obtain the whole cost by dividing the total expenses by the total tonnage. For instance, the reports of the Bunker Hill & Sullivan, a very well managed lead mine, for 20 years, give the following: 3,388,108 tons of ore were mined at an average operating cost of $2.60 per ton. Nevertheless, we find in the same reports that there were expended in the period, $3,400,000 in addition to operating costs, or $1 per ton. Since 20 years seems an ample space in which to depreciate all, or practically all, of the extraordinary expenses and the equipment of a mining property, it seems fair to me to charge up the total expenses in such a period to operating. Our real operating cost then has been $3.60 per ton instead of $2.60. Even admitting that $1,000,000 should still be held to capital account for future operations, the real cost should be $3.30 per ton.

The extraordinary nature and extent of the misconcep-

COMPARATIVE TABLE OF WORKING COSTS.

GOLD MINES.

	Period.	Tons.	Kind of ore.	Mining cost contemplated.	Development.	Per cent developed.	Milling.	Total mining and milling.	Smelting, refining, and marketing.	Total per ton.	Remarks.
Alaska-Treadwell, Alaska.	1885–1907	8,485,000	Amalgamating	0.90	*0.08	9	0.245	1.145	†0.135	1.28	*Most of the development work is in the orebody itself. †Smelting concentrates = 2¢ of crude ore. Very large vein. About 40¢ mined from open pit.
Esperanza, Mexico.	1905–1906	100,260 96,000 213,150 90,800	Smelting Concentrating Cyaniding Tailing cyanided.	5.20 5.20 5.20	0.70	14	3.33 2.58 2.58	8.53 7.78 2.58	20.62 1.60 0.30 0.30	25.82 10.13 8.08 2.88	Large vein with branches, same as El Oro. Statements complete and satisfactory. Metric tons and wet weights.
El Oro, Mexico.	1906–1907	263,149	Cyaniding	3.44	0.49	15	1.57	5.01	.....	5.01	Figures for one year only. Probably too low for average.
Cripple Creek district.	1891–1903	Crude Hand-picked smelting ore	8,750,000 3,500,000	8.00 20.00	3.20 8.00	40 40	.....	.....	4.00 10.00	12.00 30.00	Many small veins. The term smelting includes also chlorinating or cyaniding. This is done at custom works, and the cost includes the losses of gold.
Portland, Colorado.	1891–1902 1902–1906 1891–1906	Hand-picked smelting ore " "	375,196 339,604 775,100	17.20 †12.15 14.45	4.40 1.70 3.00	25 14 20	.....	.....	9.25 *7.00 8.10	26.45 19.25 22.55	*Includes amortization of chlorination plant. †Includes amortization of mining plant and property purchases.
Camp Bird, Colorado.	1906–1907	Amalgamating Concentrating Smelting	38,295	*7.96	1.56	19	2.75	10.71	1.74	12.45	*Of this 3.01 is general expense. Single vein averaging about 3 ft. wide.

COPPER MINES.

Anaconda, Montana.	1895–1907	15,400,000	Concentrating Smelting	3.59	0.30	9	*	...	*5.51	9.10	*Concentrating done at smelter. In 1905 costs were: Mining 3.67 Smelting 2.90 Refining and marketing 1.21 Total 7.78
Boston & Montana, Montana. Average of five years.	1903–1907 Inclusive.	5,400,990	Concentrating Smelting	3.18	?	?	0.93	2.06	1.55	8.22	Mining increases constantly Freight, refining, and reduction show a constant decrease.
Single years	1903 1907	907,227 1,056,785	" "	2.611 3.925	? 30	? 8	1.00 0.762	3.05 2.67	2.903 0.923	9.51 8.28	
Calumet & Hecla, Michigan.	1897–1907	17,000,000	Concentrating Smelting	2.93	?	?	0.50	3.43	0.65	4.08	Figures for this mine are of the most generalized kind. Very little can be learned from the reports except the cost of copper, which is 8.15c. per lb. The pounds per ton can be inferred pretty accurately from statements in reports, and the cost of smelting and refining may be inferred from the Wolverine reports.
Wolverine, Michigan.	1891–1907	3,000,000	Concentrating Smelting	1.46	.....	.....	0.40	1.86	0.32	2.18	Includes all expenses to date. This is one of the best records to be found anywhere.
Quincy, Michigan.	1885–1904	5,600,000	Concentrating Smelting	1.80	.....	.....	0.40	2.20	0.45	2.65	It is difficult to get the development cost of these mines with any accuracy.
Mohawk, Michigan.	1903–1907	1,913,000	Concentrating Smelting	†1.57	.....	...	*0.50	2.07	0.20	2.27	*Of this 15c. is allowed for amortization of mill and railroad. †Of this 15c. is allowed for amortization of capital in development and plant.
Tennessee, Tennessee	1901–1906	1,250,605	Smelting	1.43	0.20	15	.....	.....	*2.78	4.21	*Allows for amortization of plant from ore mined and in reserve.

LEAD MINES.

Bunker Hill & Sullivan, Idaho.	1895–1907	3,388,108	Concentrating Smelting	3.20	0.10	12.5	0.42	3.62	*3.25	6.87	*Approximate. Does not include deductions for losses. Large complex vein.
	1907	336,630	"	2.23	0.09	4	0.48	*2.71	3.64	6.35	*Charging up all expense of whatever nature incurred during year.
Federal Mining & Smelting Co. Idaho.	1905–1907 Inclusive.	2,428,112	Concentrating ore	2.60	?	...	*0.40	3.00	2.27	5.27	*Approximate. No allowance is made here for amortization of plants, but I believe all current expenses are included. An item of $300,000 is charged for development.
Southeast Missouri.	1900–1907	3,000,000	Concentrating	1.63	0.33	20	0.70	2.33	0.60	2.93	Development done by shaft sinking. Exploration by diamond-drilling.

tions of mining costs is illustrated in the most widely separated regions. Let us take the Cripple Creek district in Colorado. Messrs. Lindgren and Ransome in their U. S. Geological Survey report on that district state the gold output to the end of 1903 at $121,115,022. This came from about 3,500,000 tons of ore. When we come to examine the circumstances attending the extraction of this ore we find that it must have cost nearly if not quite $20 per ton. The figure is deducted as follows:

There had been done up to the end of 1903, outside of surface prospecting, about 150 miles, or 2,300,000 ft. of underground workings in the Cripple Creek district. In this total there was 80,000 ft. of shafts, which cost in all probability (with their equipment) not far from $75 per foot. This item would be $6,000,000. In addition to this, there were 2,200,000 ft. of drifts, cross-cuts, and

raises. These would easily cost on the average $10 per foot, or $22,000,000. Here we have a total of $28,000,000, or, in round numbers, $8 per ton merely for finding and getting at the ore. To this we must add at least $8 per ton for stoping the ore, $1 for sorting, and $2 to $3 more for amortization of plants, general expense, litigation, to bring up the total to about $20 per ton.

Freight and treatment on this ore would be about $10 more and our total cost is brought up to $30. The remaining $5 or $6 per ton was profit; which figures at about $20,000,000 in dividends. I may have estimated the mining cost a dollar too high and the freight and treatment a dollar too low, but the errors are immaterial.

At the present time undoubtedly better results, or lower costs, are being obtained at Cripple Creek. The mining costs probably do not exceed $13 per ton, but the ready explanation is that the former proportion of development work and construction work required to open up the mines is no longer done. This fact, together with the lower treatment rates, enables the mines to live on lower-grade ores. The profit obtained now is less than it formerly was, in spite of the lower costs, and it is perfectly certain that scarcely any of the mines could be operated on their present ores if they had to face the problem as it was when they were first developed.

To be sure a good deal of work has been done in the district that never paid at all. Still it can hardly be said that any large amount of work in the district was, in a mining sense, foolishly done. By far the greater portion of the 450 miles of openings was perfectly legitimate mining exploration. No one will deny that Cripple Creek has been, and is, a good district, which has added much to the gold of the country and has yielded large and well earned profits to its owners. Its 12 first and most successful years fell largely in a period of general depression when supplies were cheap and labor abundant and good; yet it cost $8 per ton to block out the ores. Many a manager has vainly tried to mine his ore at $8 per ton for everything. Some have done it perhaps for a while either by shipping waste to the mill or by neglecting development.

We turn to the reports of the Tennessee Copper Co. and find that the mining costs there have been only $1.43 per ton, as follows:

Exploration and development	$0.20	per ton
Mining and sorting	0.80	"
General expense	0.20	"
Amortization	0.23	"
Total	$1.43	"

This is the actual experience for the first five years of that mine.

At first it seems rather absurd to say that Cripple Creek mining was all right as against this record. Perhaps the Cripple Creek mines were not so well managed, for I believe few mines have had as good management as the Tennessee Copper Co., but they were legitimate, successful enterprises managed with at least an average degree of intelligence and skill. For equivalent work, taking into consideration the difference in wages, the performance of Cripple Creek is as good as that of Tennessee. The point I wish to bring out is that the fundamental differences in the conditions involves a difference of operating costs that are simply enormous and I believe that insufficient attention has been paid to the principles underlying these great differences.

In many cases the valuation of a mine depends upon a solution of the question of mining costs. If you can mine an ore for $30 per ton and sell it for $60 per ton you are doing just as good business as when you mine an ore for $3 and sell it for $6; but you will not be doing as good a business as you thought you would if you counted on mining a $60 ore for $3 per ton. The source of the greatest cost of high-grade ores is undoubtedly development work. High development costs are more particularly characteristic of non-concentrating mines. Concentrating ores usually occur in large bodies and, once found, can be developed at moderate cost. The stoping cost of a concentrate is apt to be higher than that of even the thinnest streak of hand-picked ore. In principle there is not much difference, but the concentrating mill often goes to greater extremes in selection than the miner does.

It will prove interesting to get the life histories of a number of mines. I have very few. It is difficult to find a series of reports that give the information required.

In the accompanying table I give some information gleaned from a number of published reports. The figures are not pretended to be exact, but in all cases they may be vouched for as pretty close approximations. The accuracy with which the true relations of cost are shown is proportioned to the length of the period covered.

The salient conclusion to be taken from these statistics is that in the majority of cases the costs given by mining companies, or at least popularly attributed to them, are too low, often by 30 to 50%. At least, this is the impression they make on me. The explanation of this is simple and contains nothing to the discredit of the companies that issue the reports. We may say that there are two causes for under-estimating, the first being that as the "oldest inhabitant" remembers some cold winters in his childhood and not the ordinary ones, he ends by believing that he lived in his youth in a more rigorous climate than the present, so the mine manager prefers to dwell upon the best showing that the mine has made and persuades himself that others less favorable are extraordinary. The second cause is that the later reports of a mine's operations seldom take cognizance of the large costs for plant and development incurred in the early stages. In other words, they forget that they are living partly on the surplus of former years.

In properties where there is no capital except the stock issued, where the mine pays well, where settlements are made promptly for cash, and where there is little to do in the way of finance except to see that there is enough cash kept in the treasury to meet the next payroll, there is no excuse for, and seldom is, any confusion as to how the property really stands. Here the treasurer may always know, in spite of any finesse the manager may have in the way of cost-keeping, just what the real costs are by the simple process of dividing his expenditures by the tonnage. But where capital is borrowed on bond or note issues, where the output must be held through a long process and financed, where you must figure on sinking funds and redemption funds to cover the capital invested in extensive plants, the problem is not so simple. In such cases the stockholder has the best reason for wanting to know what the real costs are; for if the cost of the year is to differ by 40% from the cost for the decade, his calculations are apt to go much more than 40% astray.

Another point is worth noting. The wide differences in costs of various mines in themselves prove that to the examining engineer this subject is of great importance. Is a partly developed property to be worked like the Treadwell or like the Portland? If the Wolverine were worked on the same costs as the Calumet & Hecla its copper would have cost to date 16 cents per pound instead of 8.4 cents. If the Calumet & Hecla were worked on the same basis per ton as the Wolverine, its copper would have cost about 4¼ cents instead of 8¼. Where experience on a big scale points to such divergences, there is a good field for insight.

Relation Between the Assay-Value of Mill Products and Smelter Contracts.

Written for the MINING AND SCIENTIFIC PRESS
By GELASIO CAETANI.

Do men running a mill always keep in mind the relation that exists between the assay-value of their product and the smelter contract under which the concentrate is sold? I hardly believe it, because smelter contracts are a wearisome kind of literature, hard to disentangle and painful to digest. The contracts are clearly worded, but the numerous discounts, penalties, and charges are at times so mysteriously complex, that it is hard to make out how much is taken out and how much left. Perhaps the smelters realize that a plain statement of the total discounts and charges would painfully impress the producer who has to sign the contract, and that it is far more humane to make him take his medicine by small spoonfuls than all at once. Any contract, however, can be expressed mathematically by a formula, and under such form be analyzed and discussed far more easily than a pageful of words.

To illustrate this, let us take as an example a contract for lead-silver ore, which we shall suppose to be worded briefly, as follows:

"The smelter is going to pay for 85% of the lead at 85% of the New York quotation, if the New York quotation is $4 or less per 100 lb. lead, and if the New York quotation is above $4, the smelter is going to pay for 85% of the lead at 85% of $4 plus one-third of the difference between $4 and the New York quotation.

"The smelter will also pay for 95% of the silver at 95% of the New York quotation.

"The freight and treatment charges will be $10 per ton of concentrate. If the concentrate assays below 45% lead, there will be an extra charge of 10 cents for each unit of lead below 45% and the reverse; if the concentrate assays above 45%, there will be a bonus of 10 cents for each unit in excess."

The contract is dual: (1) When the price of lead is below $4; (2) when $4 or more. We shall consider only the second case.

Let us adopt the following symbols:

P = Assay of concentrate in percentage of lead.
A = " " " " ounces of silver.
N = New York quotation for lead, in dollars.
Y = " " " " silver, in dollars.
V = Total net value of concentrate, in dollars.

The above contract can be expressed mathematically, as follows:

$$(1)\quad V = 0.85\,\frac{P}{5}\left(0.85 \times \$4 + \frac{N - \$4}{3}\right) + 0.95\,A \times 0.95\,Y - \$10 - \$0.10\,(45 - P)$$

Which formula can be reduced to:

$$(2)\quad V = P\,(0.45135 + 0.0566\,N) + 0.9025\,AY - 14.5.$$

This means that the smelter is going to pay $2.2567 plus 0.283 N for each 100 lb. lead, 90.25% of the silver, besides charging $14.50 for freight and treatment. If the price of lead be $5, the smelter will be paying for only $3.67 per 100 lb., or for 73.4% of the lead, besides charging $14.50 for freight and treatment.

To analyze further the contract, let us make a supposition that generally holds good for any one lead-silver mine, namely, that the silver ratio of the mill products be constant, and let us assume that in our case the concentrate contains one ounce of silver for each unit lead.

The formula (2) can then be reduced to:

$$(3)\quad V = P\,(0.45135 + 0.0566\,N + 0.9025\,Y) - 14.50, \text{ in which } V = 0 \text{ for } P = \frac{14.5}{0.45135 + 0.0566\,N + 0.9025\,Y}$$

and for N = $5 and Y = $0.65, we have

V = 0 for P = 11.0% lead.

This means,

That any product assaying below 11.0% lead is shipped to the smelter with loss.

We also see from formula (3) that

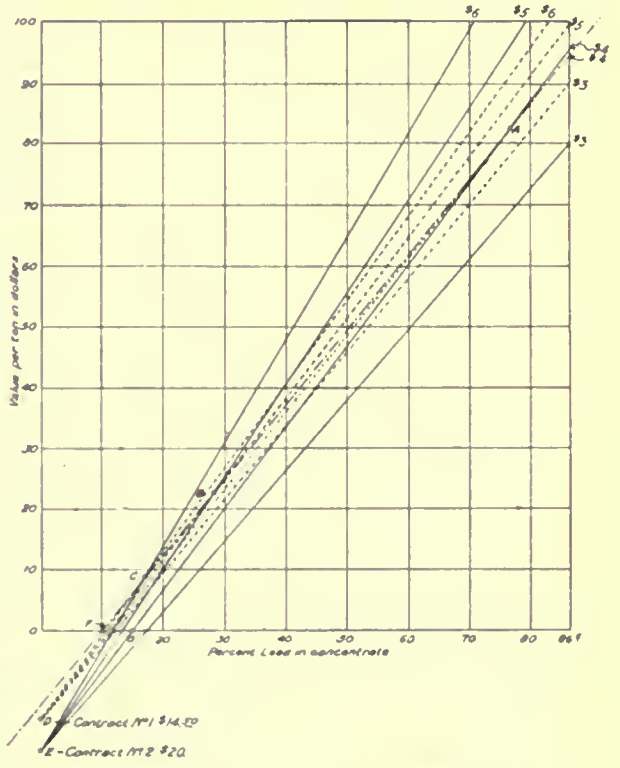
for P = 0, V = − $14.50.

This means,

That any barren sand shipped to the smelter represents a loss of $14.50 per ton.

Now let us take a mill product assaying P^1 in lead, and split it by means of a concentrating machine into two products, a high-grade product assaying P^2 and a low-grade one assaying P^3. The tonnages of the products may be called T^1, T^2, and T^3, and the following relations are known to exist:

Graphic representation of Contracts N°1 and N°2



$$(4)\quad T^1 = T^2 + T^3.$$

$$(5)\quad T^1P^1 = T^2P^2 + T^3P^3.$$

Such a separation is made in practice, for example, when re-treating a dirty Willley concentrate on a finishing table.

It is easily proved that:

The smelter contract value of the original concentrate is equal to the sum of the values of the two products sold under the same contract.

In fact formula (3) can be expressed by V = PC − D, in which C and D are constant, and if the above conclusion is correct we must have:

$V^1 = V^2 + V^3$, or $T^1\,(P^1C - D) = T^2\,(P^2C - D) + T^3\,(P^3C - D)$.

Substituting in this last formula T^1 by $T^2 + T^3$ we obtain formula (5).

The aforesaid is not true when a mining company is selling under two different contracts, or under a contract which is radically different for high-grade and low-grade concentrates. Both contracts have in such a case to be expressed algebraically and the two formulas equalled to each other. The value of P obtained from the equation will give the dividing point between the two contracts. There will be profit to split a concentrate in two products in such a way that the grade of the one

is above and the grade of the other below the dividing value found for P. The profit will be proportional to the difference between the grades of the products and the dividing value of P.

The three conclusions previously stated lead to the following further conclusions:

By eliminating from the concentrates any part of them assaying 11% lead we shall reduce the tonnage of the concentrates without diminishing their total net value.

This is important to be kept in mind where the concentrate is hauled a long distance to the railroad.

We can also say that:

By eliminating from a concentrate any part of it assaying less than 11% lead we shall reduce the tonnage and increase the total net value of the remaining concentrate.

I have known mines selling their concentrates under less favorable conditions than those of the contract I have taken as an example. By doing some figuring, more than one superintendent will be astonished to find out what a high-grade tailing he can profitably make. A low tailing is not by itself a proof of good milling, and in a general way we can say that the tailing can be higher when the market value of the metals is low.

Low-grade concentrates will result in low-grade tailings, but there is a point at which there is a greater loss due to unprofitable material shipped to the smelter than to the lead escaping through the tail-race. On the other side it may be said that high-grade concentrates are liable to cause undue losses in the tailings. This is especially true with fine slime. As an illustration, I may mention the slime that is treated on the vanners in the Bunker Hill & Sullivan mill in Idaho.

The vanner-feed assays about 19% lead and 9% silver. When the market value of lead is high the feed could be shipped directly to the smelter (if the smelter would accept such low-grade products), with greater profit than can be actually recovered by a single vanner concentration. By making a low-grade concentrate it is possible to obtain a shipping product without diminishing greatly the net profit per ton treated, but as soon as it is attempted to make a high-grade concentrate both the extraction and the profit decrease rapidly.

If the market value of lead falls to a certain value almost the same profit can be made by shipping the feed, as by making a high-grade or a low-grade concentrate. But for lead at, say, $3.50, it pays decidedly to make a clean concentrate.

I cannot follow here the multiple conclusions to be reached in milling by keeping in mind the relations that exist between the grade of the mill products and the smelter contracts. Conditions are different in each practical case, but one fact will be generally found to be true, namely, that it always pays to concentrate in two or three stages.

In the first stage of concentration the bulk of the ore handled is great, and the production of a high-grade concentrate will surely result in a heavy loss. It is well at first to make a low-grade concentrate and to re-concentrate with greater care, providing special means for re-treating the middling produced. The concentrates produced at this second stage have to be physically analyzed, and if they are found to contain some high-grade sand that cannot be separated from its included mineral and cannot be shipped with profit, it is well to make a third separation and to let part of the lead run down the creek to the advantage of the present and future generations.

Before closing the subject I may still say that any contract that can be expressed by a formula can be represented graphically. The contract expressed by formula (3) is represented by a family of straight lines having the point V = — $14.50, P = 0 in common.

This is shown in the diagram (Fig. 1), Y being supposed to be constant and equal to $0.65, and N variable, as has lately been the case. On the same diagram is also represented a second contract in common use for lead-silver ores, and which can be expressed by:

$$(6)\quad V = 90\%\ PN + 95\%\ AY - \$20.$$

Assuming the contract to be applied to the ore taken as the subject of this discussion, we can simplify the formula (6) to:

$$(7)\quad V = P(0.6175 + 0.18\ N) - 20.$$

Both contracts have been plotted on the diagram for values of N equal to $3, $4, $5, and $6.

We see from the diagram that:

(a) In the second contract the value of a concentrate is more strongly affected by the variations of the market value of the lead, than it is in the second contract.

(b) That for a certain value of N there is a value P^0 of P for which the value of a concentrate is the same under both contracts. All these points P^0 lay along the line marked A B C.

(c) All concentrates assaying higher than P^0 are sold to better advantage under the second than under the first contract, and the reverse, all concentrates assaying less than P^0 must be sold under the first contract.

The complete discussion of the diagram would lead us beyond the limits of this article, and I shall therefore not attempt to enter the subject more deeply.

There are other factors, besides the smelter contracts, which have to be taken into consideration in milling. They can be expressed by three words: Cost of production. By keeping all these factors in mind, milling can be brought close to its maximum economic efficiency, and if ever this point is reached it is well to look around once more to see whether we are right after all.

Tube-Mills on the Rand.

There are between 50 and 60 tube-mills at work upon the Rand. Tube-mills have come to stay on the Rand, as has been the case wherever they have been judiciously introduced. The place of the tube-mill in gold-milling is assured, but still their use is in a very unsettled state. There are many different kinds of lining, each with its advocates; similarly other matters connected with tube-mills are mooted questions. Recently Kenneth L. Graham ran a series of tests at the Geldenhuis Deep in which he used in one mill Danish pebbles, in the other pieces of common 'banket.' Both tube-mills were 22 ft. long by 5 ft. 6 in. diam., both were lined with silex blocks, and in both the conditions during the test were kept as nearly the same as was possible. The results of these experiments, extending over a period of a month, showed a distinct advantage in favor of the banket against the imported pebbles. Not only was there a saving in the cost of the banket compared to the Danish pebbles, but it appeared that the wear on the mill was less with the banket. Former less extended experiments on the Rand indicated that it was cheaper to use Danish pebbles. At Pachuca it has also been found that the use of the local supply of quartz is far cheaper than the use of imported pebbles. Hard 'nigger heads,' which occur in many quartz veins, are especially good for the grinders in tube-mills. This subject of using the ore itself as grinders in tube-mills is worthy of quite careful investigation elsewhere, especially as the saving at the Geldenhuis Deep was £13 for the month.

Precipitation of Copper From Cupriferous Waters.

Written for the MINING AND SCIENTIFIC PRESS
By FRANK H. PROBERT.

Seven years ago I was privileged to investigate the several methods of extracting copper from lean ores by wet processes at Rio Tinto and Tharsis, in Spain. Within the last year, while examining mines at Butte, Montana, my attention was called to the slipshod methods of winning some of the copper from the cupriferous mine waters and from Silver Bow creek. While at Butte I was struck with the very crude methods and appliances used and the low extraction obtained. It may be said that the copper waters cost the mining companies practically nothing and that the rough methods employed for the extraction of a percentage of the contained metal costs very little more, but if a slight modification of the plant and a little more attention to detail will insure a greater extraction at practically the same cost, after the installation of the plant, then I take it the subject is worthy of investigation. The question resolves itself into one of economies and it would probably not pay to remodel such precipitating plants as have already been erected, but since the waters of Silver Bow creek are a never-failing source of revenue to the companies over whose claims they run, it is worth while to ascertain the conditions and plant likely to insure a high rate of extraction. There are probably many other camps in which quantities of copper-charged waters are running to waste and as the following remarks and suggestions apply in all cases where cupriferous water is to be handled, a description of the practice may be welcome. I shall first of all briefly describe the Rio Tinto practice from the time the liquors, as the copper-laden waters are called, leave the ore-heaps until they are returned to other heaps for further work. The process is continuous. Then it will be my object to show how such steps in the process as are suitable may be applied at Butte.

The huge masses of ore in the province of Huelva, Spain, that are treated by this 'natural cementation' process, consist essentially of massive iron pyrite containing from a mere trace to 1% copper. The mineral as laid down in the heap for oxidation and subsequent leaching contains an average 2% copper. It is probable that this copper exists in the form of finely disseminated particles of chalcopyrite scattered through a matrix of iron pyrite. It is really a cupriferous pyrite. The ore is crushed to pass through a 2½-in. ring, it is mixed with about 30 % of finer material, and is then laid down in heaps covering an extensive area, about 30 ft. deep. The method of laying down these heaps and insuring a free

Precipitating Copper at Rio Tinto.

circulation of air through them at Rio Tinto has from time to time been described in the technical press. As it has little or nothing to do with the subject under discussion it is not necessary again to describe it. The heaps are irrigated continuously with water and spent liquors. The washing of the heaps serves three purposes:

1. To keep the temperature down.

2. To form ferrous sulphate and free sulphuric acid, which react to produce ferric sulphate; the latter acts upon the cuprous and cupric sulphides to form copper sulphate.

3. To dissolve the sulphate of copper formed and to carry it away from the heaps.

It is found that a crust of ferrous and copper sulphates sometimes forms an impervious layer on the top of the heap. When this happens an iron bar is inserted, the crust is broken up and turned over. The copper-charged waters running away from the heaps are now taken to the precipitating vats for treatment.

The fundamental principle underlying precipitation of copper from waters by means of iron is expressed in chemical terminology (1.) $CuSO_4 + Fe = FeSO_4 + Cu$, but

there are other reactions to be taken into consideration, as

(2.) $Fe_2(SO_4)_3 + Fe = 3FeSO_4$.

(3.) $H_2SO_4 + Fe = FeSO_4 + H_2$.

(4.) $Fe_2(SO_4)_3 + Cu = CuSO_4 + 2FeSO_4$.

The copper liquor as it leaves the heaps contains much ferric iron, which would (as is shown by equation No. 2) cause an unnecessary consumption of scrap iron. The ferric salt is reduced to the lower oxide before it enters the elaborate plant by passing it through a small heap of 'fines' of the raw ore, and the analysis of the effluent liquors shows that approximately 90% of the persalt is reduced to protosalt. The following table gives the analysis (in grams per cubic metre) of the entering and leaving liquors of the precipitation plant at Rio Tinto at the time I was there:

	Entering.	Leaving.	Entering.	Leaving.
Copper	2,710	19	2,780	19
Ferrous iron	13,908	17,202	14,030	17,934
Ferric iron	610	.....	732	.....
Free acid	4,874	4,129	4,991	4,349
Total solids	70,872	69,662	71,980	72,834
Specific gravity	105.818	105.718	105.901	105.972
Consumed iron	1.26	to 1 Cu.	1.26	to 1 Cu.

The best results are obtained when the solution is slightly acid, as it tends to accelerate precipitation and prevents a falling out of basic salts of iron while precipitation is going on.

The liquors are sampled every four hours at Rio Tinto at different points in their path through the vats, so that an absolute check is kept on the reaction. So perfect is the system that Mr. Hart, superintendent of the leaching plant at Tharsis, told me that the amount of copper, calculated from the solution, differed from the actual copper output from the vats during the period of 12 months by only 15 tons.

The precipitation vats are really a series of canals in which the liquors give up their copper. They are arranged in sets, each set consisting of from 4 to 6 vats. Both at Rio Tinto and Tharsis the liquor traverses about 3 kilometres before all the copper is precipitated. The vats are lined with timber 9 by 3 in., the joints being caulked with ropes to prevent leakage, and the whole covered with tar, pitch, or asphalt. The walls dividing each set of vats are made of rough stone or masonry, lined in the same way. There is a gradual fall through the series from start to finish. At Tharsis the inclination is as follows:

For the first 40% of the copper	1 in 200
" " next 30% " " "	1 in 150
" " " 20% " " "	1 in 100
" " remainder	1 in 50

Here follow the details of the vats at Rio Tinto:

Division	1 to 2.	7	vats	each	98	m.	long	by	1.22	sq.	m.	in section.
"	2 to 3.	2	"	"	70	"	"	"	1.81	"	"	"
"	3 to 4.	3	"	"	44	"	"	"	1.30	"	"	"
"	4 to 5.	3	"	"	125	"	"	"	1.28	"	"	"

In division 5 to 6 there is a parallel series about 65 sq. m. section, with a total length of about 1600 m. of shallow vats. Divisions 1 to 6 receive from 380 to 450 cu. m. of liquor per hour, assaying from 2600 to 3000 gm. copper per cubic metre.

The presence of ferric sulphate or free acid in the liquors causes an unnecessary consumption of pig iron, hence, when the proportion of sulphuric acid to copper is higher, the liquors are made to flow faster by passing them to lower vats in the series where the gradient is steeper. Another reason is that the tendency for basic sulphates and other impurities to precipitate increases as the quantity of copper falls and the free acid rises. To take advantage of these mechanical and chemical details and obtain maximum extraction at minimum cost, the analysis of the liquors must be known from start to finish.

The precipitant at Rio Tinto and Tharsis is pig iron, the pigs being laid in the vats like chequer work, four pigs deep. The great objection to using pig iron is that when the surface becomes coated with copper, the action goes on slowly. The shell of copper protects the iron. The chequer-work arrangement of the pigs exposes a large surface of iron to the liquors, but far greater exposure obtains when scrap iron is used.

Referring once again to the equation

$$CuSO_4 + Fe = FeSO_4 + Cu,$$

and interposing the atomic weights of the elements, we find that (in chemical exchange) 56 parts by weight of iron are equivalent to 63 parts by weight of copper. This is the theoretical exchange. In practice many other inter-actions occur, depending on the analysis of the liquor.

The first reaction that occurs in the liquor running over metallic iron is the reduction of the ferric sulphate to the ferrous state. It is therefore advisable to preclude every chance of oxidation. The second reaction is the precipitation of the metallic copper, brought about by simple galvanic action. The iron becomes cased with copper and thus the iron and copper in the acid liquor constitute a galvanic couple with considerable difference of potential. It is due to electrolytic action that all metals electro-negative to iron are precipitated.

While the liquor is fairly strong in copper, the copper is mostly precipitated in a coherent form, but in the later stages (as the liquor becomes impoverished) it is precipitated in a powdery state and with it a larger precipitation of impurities. The consumption of pig iron to the precipitation of the copper varies inversely as the quantity of copper in the liquor.

The temperature of the solution is also a factor in precipitation. During the summer months precipitation goes on far more rapidly than in winter. A temperature of 100° F gives excellent results.

The exceptionally good work performed at Rio Tinto and Tharsis is proved by the fact that only 1.4 units of pig iron containing 92% iron are consumed per unit of copper obtained. Sixty per cent of the copper in the liquors is precipitated within the first 760 metres of the vats. Over 70% of the precipitate contains more than 94% copper.

The following points have been established by this summary of Rio Tinto practice:

1. The complete analysis of the solutions both before and after treatment is essential to prevent undue consumption of iron.

2. Free acid is to be eliminated as much as possible.

3. Mechanical contrivances will, in a measure, overcome these chemical difficulties. The inclination of vats and consequent velocity of current should be in inverse ratio to the amount of copper present; the less the copper and the greater the free acid and ferric iron, the greater the inclination necessary.

4. As large a surface of iron should be exposed to the liquors as is possible.

5. Aeration of the liquor by tumbling through the air is objectionable, since it is an oxidizing reaction and so increases the consumption of iron.

6. In the course of the flow of the liquor through the vats there is a place where the cost of iron exceeds that of the value of the copper obtained.

7. The warmer the liquors, within certain limits, the faster is the precipitation of the copper.

At Butte, previous to the removal of the reduction works to Helena and Anaconda, the smelters and concentrators of the producing mines were built along Silver Bow creek. Enormous masses of tailing and slag carry-

ing appreciable quantities of copper, both as oxide and sulphide, have been dumped here and allowed to accumulate until the original course of the stream has been obliterated. The copper-charged waters pumped from the mines all ultimately find their way into the creek.

A reputable engineer, who has worked for years in the Butte district, claims that the flat through which Silver Bow creek runs will average nearly 2% copper for a depth of several feet. There are thousands upon thousands of tons of this material offering a wide field for close figuring and careful study in the extraction of copper. If a few experiments will determine what arrangements give the best results, why not investigate it? The water of Silver Bow creek is very acid and contains (from its contamination with mine waters) salts of copper and iron. I question whether a complete analysis has ever been made of this water. This same engineer tells me that a few samples of the water tested showed from 0.02 to 0.074% copper. No determination of the ferrous and ferric iron and free acid was made. I doubt not that it is an ideal solvent for the copper in the tailing provided it can get to it. I would suggest that periodically the surface of the tailing be turned over with a plough or that numerous small pits be dug from time to time in the flat—anything to insure greater contact action and more rapid percolation. A rough dam might advantageously be built across the lower end of the narrow channel; this would stay the underground flow and catch the richer liquors near bedrock. Anything that would cause more intimate contact with the interior of the pile of tailing is a move in the right direction. The idea of ponds on the tailing-bed is good, but I doubt very much whether, if actual tests were made, the percolation factor would be appreciated.

Precipitation Plant at Butte.

It is estimated that the Parrott precipitation plant alone cleans up about $25,000 per month, while extracting but a small percentage in the solution. The consumption of scrap iron is figured at four units of iron per unit of copper obtained. I noticed while visiting the several primitive plants in Butte that it is a common practice to elevate the solution to the top of a tower and allow it to tumble through a series of racks on which the scrap iron is placed. I cannot see the object of such a method of procedure unless it be that the fall of the water breaks the thin film of precipitated copper and exposes fresh surfaces of iron to the liquor. I think it would be better to use wider and deeper boxes, lessening the velocity of flow and arranging the scrap iron so that a larger surface area is exposed to a given quantity of liquor. As I have said before, little or no attention is given to the extraction obtained. By using more vats, and regulating the flow through them, I am convinced that much more remunerative results would be possible. Both the entering and effluent waters should be tested at least twice a day for free acid, ferrous and ferric iron, and copper sulphate. The ferric sulphate liquor returned from the precipitation vats will slowly dissolve more copper from the tailing and, being re-charged, is ready for re-precipitation.

There is a great field for economic work along these lines. I do not advocate such elaborate schemes as are practised in Spain, but much can be learned by a small expenditure of money to increase the extraction and reduce the cost.

HEALTHY COMPETITION.—While unquestionably dangers can be foreseen as arising out of these great industrial aggregations—not only of capital but of industrial energy—dangers technical, social, and political—there are also great possibilities of good. One of the benefits may justly be claimed to reside in the large funds that are thus rendered available for technical research, from which the public derives benefit indirectly, even if the results are not published. But if we could banish secrecy; if every industrial establishment of any magnitude, which is in its own interest carrying on technical research, should encourage its technical staff to confer freely with the members of every other technical staff, would not the sciences and arts progress far more rapidly than if one huge organization controlled a given industry? All our principal metallurgical and chemical concerns have laboratories, and carry on investigations and make experiments, generally on a large working scale; and surely the advancement of technological science can be better attained in a number of such laboratories than if there were fewer or in only one. There is keener competition of wits when many are working independently. The friction of honest rivalry is a force not to be despised. The stimulus of ambition is sure to be stronger in smaller than in large consolidated workshops. The air in such laboratories is freer and purer than when men are working in the stifling atmosphere of secrecy. I believe that such a consolidation of mind and high impulses would carry us further and faster along the road of human progress than all the money that all the trusts could appropriate for the advancement of technical knowledge. —James Douglas.

BABBITT METAL, as originally manufactured, contained tin, copper, and antimony. The composition now sold under this name has lead as the basis, and a combination of lead and antimony makes a good anti-friction metal. Some brands of babbitt metal are simply the refuse from type-foundries or smelting works. In pouring, the metal should be just hot enough to char a dry pine stick, and a combination of asbestos-fibre and a heavy oil, made into a stiffly-plastic mass, makes a good material for the dams. It is not a good plan to use the steel shaft in casting the bearing, as the hot metal may spring it. A wooden mandrel is better.

The Smelter of the Mammoth Copper Mining Company, at Kennett, California.

Written for the MINING AND SCIENTIFIC PRESS
By DONALD F. CAMPBELL.

The site of the Mammoth Copper Mining Co.'s works near Kennett, on the Sacramento river, is naturally well adapted for the purpose, for the Mammoth mine, supplying sulphide ores, is within easy reach, abundant limestone occurs in the immediate vicinity, and quartz is available from the Quartz Hill and Old Diggings districts. The Mammoth smelter is owned by the United States Smelting, Refining & Mining Co.; the Mammoth Copper Mining Co. being the operating title of the local organization, for the parent company owns mines and smelters in Nevada, Utah, Kansas, Indiana, New Jersey, Mexico, and Peru.

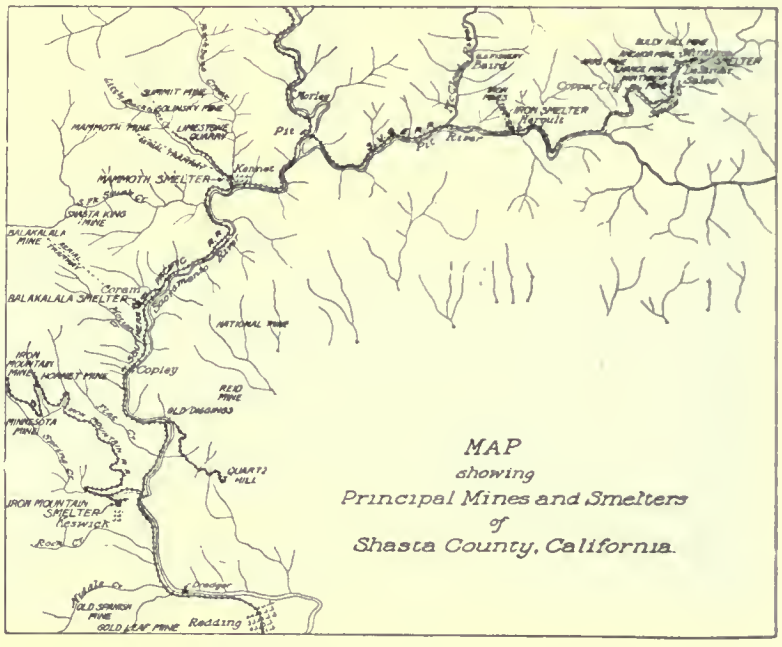
The development of this smelter is characteristic of the rapid growth of the copper mining industry in Shasta county. This enterprise was started about three years ago by the development of the mine, which is situated at a distance of 13,000 ft. from the smelter and at an elevation of 2,300 ft. above it. The ore is carried over an aerial tramway built by the Riblet Tramway Co. The tramway discharges into bins from which the ore is loaded into the charge-cars. Limestone is hauled to the smelter from Holt & Gregg's quarry, an electric road connecting this quarry with the smelter. Silicious ore and coke are brought from the outside, the railroad cars running over the top of the receiving-bins and discharging into them. The profile between the mine and the smelter is difficult and the sticky character of the ore also renders the existing method of transport unreliable and insufficient to meet the demands of the enlarged smelting works now being constructed. In consequence, the aerial system will soon be abandoned and a gravity incline used in conjunction with electric and steam railroads. The terminal machinery for the former will necessarily be massive, for the incline is 4,000 ft. long with a vertical drop of 1,700 ft. On this slope, which has a varying grade, two standard-gauge cars of nearly 20 tons capacity will be operated, the brake energy being partly absorbed by driving a compressor.

The Mammoth mine, which supplies the sulphide ores, is one of a series of masses irregularly distributed in a succession of rhyolite flows of pre-Devonian age along the west side of the Sacramento river. No proof is established that these orebodies are confined to any distinct lava and the various flows have not been clearly differentiated. Ore deposition has occurred by the total replacement of blocks of rhyolite bounded by fissures and shear-zones. Within these blocks the orebodies frequently show but little trace of the original rock, although in some cases the quartz phenocrysts can be distinguished.

At the Mammoth mine the ore is a massive pyrite containing from 3 to 12% of copper and carrying a uniform quantity of precious metals to the value of $1.50 to $3 per ton, a factor which materially adds to the prosperity of this enterprise during the vagaries of the copper market.

Many of the orebodies of Shasta county assume enormous proportions and are remarkable for their uniformity of character and comparatively shallow depth. The Mammoth ranks among the large copper mines that have been developed in the United States during the last decade, and the orebodies of the district have added notably to the known copper resources of the world, being surpassed only by the enormous low-grade deposits of Bingham and Ely and, possibly, the rich lodes in course of development in the Katanga district of the Tanganyka Concessions in central Africa. The value of the ore blocked out at the Mammoth was recently reported to exceed $15,000,000, but this must now be modified in view of the lower prices for the metal.

Diamond-drills have played an important part in the development of the mine and have met with success. They find application especially in blocking out orebodies when they are partially opened up, because the sulphides can be drilled more cheaply than the adjoining country rock. The latter is often highly silicified and in such a case the cost of drilling is almost prohibitive. Vertical holes driven down through the gossan ascertain whether it covers valuable sulphide deposits, for many such outcrops occur, beneath which the oxidation has been so complete that nothing of value is left, while other masses, especially of low-grade ore, being protected by a layer of rhyolite, have little or no outcrop. The cost of drilling in these rocks may vary from $1.75 to $4 per foot, and where time is an important object, this method of prospecting, being nearly four times as fast as mining, is satisfactory.



At the Mammoth smelter, from 300 to 350 tons of quartz is required per day; the company, finding the local supply of custom silicious ore altogether insufficient to meet this demand, has recently built a narrow-gauge road to the Quartz Hill mine, which has been leased for a long period. This deposit consists of a series of low-grade lenses of quartz carrying from $1 to $6 in gold, and about 93% silica, the latter being purer than the majority of local ores.

Regular shipments are also made from other adjacent mines.

As a result of numerous experiments and gradual development, the smelting of these ores is now economically accomplished. At first, the ore was all roasted, then pyrite smelting was successfully applied and developed to the extreme, until the consumption of coke was reduced to a fraction of 1%. The economic limit was exceeded, and at the present the coke in the charge varies from 3 to 4 per cent.

General View of the Mammoth Plant of the United States Smelting, Refining & Mining Co., at Kennett, California.

Interior of the Mammoth Smelter. Settler and Matte-Conveyor.

The plant is equipped throughout with the most modern machinery and a splendid system of store-houses and workshops. One building, 414 by 42 ft., contains electric, boiler, machine, and blacksmith shops, and at the end is the round-house, for the switch engines and a repair-shop for the mine railroad, the entire building being served by a 5-ton traveling crane and a complete hardware-store in the upper story of the building. Motive power is supplied by the Northern California Power Co.'s plants in the Sierra Nevada and about 3,000 hp. is used for blowing engines, compressors, and transportation.

The present plant has three blast-furnaces, each 42 by 180 in., with brick tops. The flow of matte is continuous from settlers, 6 ft. 9 in. outside diameter, into pan-conveyors which discharge into barrows. These barrows are wheeled on a platform to scales where the matte is weighed and then loaded into cars for shipment to the converter-plant in Utah. The cooling of the matte, while carried by the conveyor, is not sufficient to eliminate danger of putting the car on fire if loaded directly and for that reason the matte is dumped and cooled with a spray of water before being loaded into the cars.

The slag discharges from the settler into a swivel-pot from which it overflows into the slag-pot. The swivel-pot collects some of the matte that is carried over by the slag. It is found, however, that the amount of matte thus collected is very small. The settling in the receivers appears complete in spite of their small size. The slag is then hauled by electric locomotives to the dump. The track and the dump are situated on a level 8 ft. below the tapping-floor. This arrangement is convenient, as there is no interference of the slag-trains with the smelting operations.

The dust-flue is of brick, 200 ft. long and with an area of 156 sq. ft. It has hopper-bottoms through which the dust is drawn into cars running on tracks underneath. These cars are wheeled to an elevator and raised to a bin from which the dust is fed on a belt-conveyor discharging into the briquetting machinery. The stack is self-sustaining and of steel 12 ft. diam. and 150 ft. high above the base. Between the dust-flue and the stack there is a dust-chamber 60 ft. long and 456 sq. ft in area.

The power-plant contains three Connersville blowers of 124 cu. ft. capacity per revolution and having a speed of 132 r.p.m. These blowers are driven by three 200 hp. 2,000-volt 3-phase induction-motors made by the Westinghouse compauy. Two of these motors run at constant speed and the third is a variable-speed motor. A 100-hp. motor-generator set furnishes direct current for the locomotives.

Hitherto a 20 to 30% matte has been the product of the smelter at Kennett, this being shipped to Utah to supply the demand for the iron that is mixed with the silicious ores of Bingham. Of the three blast-furnaces at present in service, one has a steel water-jacketed top which is giving excellent results. So satisfactory has this improvement been, in preventing heavy incrustation and consequent freezing, that it will soon be adopted on all the furnaces. A light crust is constantly forming on the upper part of the furnace, but this soon falls off in scales; not only does it prevent the thick incrustation and subsequent freezing or low capacity that is usual with the brick tops, but this water-jacketed top also forms a scale of sufficient thickness to cause it to fall back into the furnace instead of being carried upward as flue-dust. This is an important development in blast-furnace construction.

The smelter plant is being much enlarged and it is expected that all the additions will be completed in January, 1908. Two blast-furnaces are being added; these are 50 by 180 in. with water-jacketed tops and settlers of 16 ft. diam. and an intermittent tap. The brick tops of the old furnaces will also be replaced with steel water-jacketed tops.

A building is being added for two converter stands and eight shells 96 by 150 in. The converter-building will be supplied wih two Morgan electric overhead cranes of 50-ft. span and with a main hoist of 50-ton capacity and two auxiliary hoists of 15 tons each, equipped with G. E. 440-volt induction-motors. In the power-house there will be added four Connersville blowers of the same size as the three original ones, but run by G. E. motors of 225 hp. A converter blowing engine of 10,000 cu. ft. capacity at 15 lb. per sq. in. will be driven by a 750-hp. 2,080-volt G. E. motor. In the extension of the converter building will be placed a re-lining plant with two pneumatic tapping machines of Ingersoll-Rand pattern, each supported by a hydraulic jib-crane of steel.

A dust-chamber, 200 ft. long and 407 sq. ft. in section, provided with hopper-bottoms, will be built of brick supported on a steel framework and concrete. A new self-supporting steel stack 18 ft. diam. and 200 ft. high has just been completed, into which the blast-furnace gases will be carried, while the old stack will serve the converters.

PRICE OF DIAMONDS.—This has been controlled for some years by a powerful combination of diamond merchants in London. Since the Boer war the value per carat has been steadily rising. The question of keeping up the price of diamonds, with a largely increased supply in prospect, is one that is frequently discussed, and leading authorities are agreed that at least twice the present annual supply could be absorbed without affecting the price per carat. But it is considered that only the better class of stones will always be in demand. The value per carat of the diamonds recovered from the principal producing mines, according to their latest reports, is: De Beers and Kimberley, $12.68; Wesselton, $8.86; Bullfontein, $8.38; Dutoitspan, $16.78; Jagersfontein, $13.86; and Premier, $5.64. Every diamond mine produces a certain amount of rubbish worth about $2.16 per carat; the percentage of these poor stones found determines the average value of the yield. At the Premier mine 75% of the total money value produced was represented by diamonds worth $12.60 per carat, and the balance of 25% was made up of diamonds worth $2.16 per carat. Similar variations in value occur in the stones found in all diamond mines. As showing the gradual increase in the average price realized per carat during the last 20 years, the following figures, taken from the report of the New Jagersfontein mine, may be of interest: 1887, $6.80; 1891, $8.92; 1895, $7.46; 1899, $8.28; 1903, $13; and 1905, $13.88. Since the issue of the report for 1905 the average price per carat has risen a further 5 per cent.

SWELLING GROUND is not confined to slates alone. Some igneous rocks swell upon exposure in mine workings. Experience has shown that the best way to keep drifts and other mine workings open in swelling ground is to timber heavily, spreading the legs of the sets widely at the bottom, and to 'lag open' in order that the swelling ground may find an easy passage through the spaces between the lagging. This method also admits of cutting away and removing the encroaching ground, thus keeping the main members of the set in their proper position. It has been found that almost every attempt to closely lag ground of this character has resulted in bending and breaking the lagging and in forcing the legs of the set out of place—often breaking or crushing the timbers. Large timbers offer little additional resistance over small ones in swelling ground.

The Mineral Resources of Sonora.

Written for the MINING AND SCIENTIFIC PRESS
By F. J. H. MERRILL.

Sonora covers an area of 77,000 square miles, all of which is highly mineralized. Deposits of gold, silver, and copper occur in remarkable abundance and, under modern management, many have developed great commercial importance, while hundreds remained unworked since their abandonment during the revolution against Spain from 1810 to 1821.

In silver production, during the Spanish occupation, it was surpassed by some of the interior States, and none of its mines have equalled the great producers of the central plateau, but from the beginning it has been, as it still is, the chief producer of gold and is also first in production of copper. Long before the Spaniards came, in 1521, the natives had developed primitive methods in mining and metallurgy, which gave them large quantities of precious metal, and copper or bronze implements were in use; but to what extent they conducted underground work is not known.

Sonora is pitted and honeycombed with abandoned shafts, open cuts, and underground workings which are now called *antiguas*, the term probably referring to all mining done before the revolt against Spain in 1810. In the clear atmosphere, on the treeless hills and mountains, the traveler sees everywhere the openings of the old workings that record the mining industry of the early days. In this climate of small rainfall and slow erosion, the gradual decay of vein-stones and impregnated rocks, wherever exposed, resulted in rich surface accumulations of precious metal, especially near the exposures of gold bearing veins and, in these detrital deposits or placers, the first miners reaped a rich and easy harvest. Later, under Spanish rule, the introduction of the *arrastre*, the use of quicksilver and various technical devices, gave the miner control of a larger field of action and new sources of profit.

Practically no machinery, however, was used in mining, and the notched log or 'chicken ladder' with the rawhide bucket on the back of the *peon* was the primitive substitute for modern hoisting and pumping machinery. So, also, the slow boring of shallow holes and the breaking down of the ore by the expansion of quicklime packed in the holes and moistened, made but a humble and inefficient substitute for the use of modern machine-drills and dynamite.

As a result of these conditions, work was limited in depth for lack of pumping machinery and in thoroughness by imperfect methods of extraction. The *arrastre* could be erected and worked without capital other than that needful to command the services of a cheap mule or burro and, since the slowness of the process was unimportant, and little or no value was assigned to the labor of man or beast, it was effective on free-milling gold ore, even of very low grade, but useless for the extraction of gold from sulphides. One therefore usually finds that an *antigua* mine has not been exhausted in depth unless the orebody was very shallow and that, in the old workings and below them, there often is rich ore unfit for the *arrastre* but available for modern metallurgy. Further, there may be waste dumps rich enough for treatment by modern methods, and at one time substantial returns were gained by a company which sent out a portable cyanide plant to treat the dumps of old *arrastre* tailing.

The Mexican native had, and still possesses, a keen instinct for the valuable ores in his native district and has probably left untouched no exposed deposit fit for treatment by his simple methods.

The ancient mine-workings or *antiguas* of Sonora are of much interest, for many of them have become richly productive in the hands of people with capital and up-to-date methods. Wherever the ancient miners worked extensively it may be inferred that they found ore profitable for treatment by their methods. That these old mines were rarely worked out is due to several reasons:

First, the lack of means for handling water, since many *antiguas* show rich ore when unwatered.

Second, the fact that the old miners knew nothing of the geology of ore deposits and did not appreciate that an orebody might be expected to pinch out or to be cut off by faults, and that a new orebody or the continuation of the first might be found by exploration. The old Mexican miner only followed the ore and knew nothing of systematic development.

Third, the early miners only sought for ores which could be worked in the *arrastre* or reduced in their simple *adobe* furnaces. Any gold ore, not free milling, or any silver ore from which the metals could not be recovered by their simple treatment, was useless.

Copper was of little interest to them and it is not known that any mine was actively worked for copper. The Aztecs, however, used some copper tools and a small quantity of this metal was used by the Spaniards for church bells.

Antigua mines differ very much in appearance from mines of the present day because the following of the ore was the only purpose in view, and little if any country rock was taken out. The underground workings are therefore of very variable dimensions and extremely irregular in direction. Where the roof needed support, this was more often supplied by pillars than by timbering, and in later years *gambusinos* and others have robbed the pillars and allowed the ground to cave. The *antiguas* are therefore generally full of water or caved in.

These remarks on *antigua* mines and mining necessarily apply to other parts of Mexico besides Sonora.

The geology of the State has been outlined elsewhere.[1] A summary of the subject may be given by saying that the following formations have been recognized: Crystalline terranes of gneiss and reddish granite are seen in Altar. The latter occurs also in Magdalena, and may or may not be equivalent to the granites of the southeastern districts. An extensive limestone formation, underlain by quartzite, occurs throughout the northern border of the State, apparently equivalent to that of Bisbee, Arizona, which ranges in age from Cambrian to Carboniferous. In central Alamos there is a limestone containing Paleozoic fossils, but its relation to the northern limestone is not yet known. A series of upper Triassic beds, carrying some coal, and graphite outcrops in Sahuaripa, Ures, Hermosillo, and Guaymas. Cretaceous limestone and shales are exposed in Ures and eastward, and lastly a great volcanic series of lava, tuff, plugs, dikes, and sills of quartz-porphyry, rhyolite, dacite, and andesite appears in all the districts, and contains many of the orebodies. Some of the copper deposits, however, are in limestone. Intrusive granites and diorites also occur at many points, but are not known to carry much ore.

Administratively, Sonora is divided into nine districts: Altar, Magdalena, Arizpe, Moctezuma, Ures, Hermosillo, Sahuaripa, Guaymas, and Alamos. These are similar in importance to our counties, but are better known to Americans as the bailiwicks of mineral agents with whom mining claims are filed for record, and of stamp agents through whom mining taxes are paid to the Secretaria de Hacienda in the City of Mexico.

While the mines are legally grouped in districts,

[1] *The Engineering and Mining Journal*, November 25, 1905.

geologically and topographically, they are grouped by the mountain masses and areas that carry the veins and orebodies. In general, mineralization is more conspicuous in the mountains than in the lowlands. This is partly due to the fact that the valleys, basins, and plains are more or less covered with debris from the mountains so that, in them, rock and vein outcrops are more commonly buried, while the mountain slopes, bare of soil and vegetation, expose the outcrops so that they can be seen from afar.

This condition is, however, also due to the fact that some of the basins and valleys have not been carved out of the mountains, but lie between volcanic peaks and ranges formed by the flow of lava through vents and fissures. From this it follows, that the geology of the valley or basin is often different from that of the adjacent mountains, and it frequently bears a different type of mineralization.

From the necessary dependance of the mining industry on transportation, the mines are commonly considered in relation to the valleys, which are the thoroughfares of commerce. .The chief gateways of Sonora from the north are three: Nogales by the Sonora railway, Naco by the Cananea railway, and Douglas by the Nacozari railway.

The first of these lines occupies a chain of valleys and basins, from the National boundary to Guaymas, and from this central depression extend tributary valleys and plains, which give access to the adjoining country east and west. Through the valley of the Cocospera at Imuris runs a stage-line to Cananea. Through the Magdalena valley from Santa Ana run stage routes to various parts of Altar.

From Hermosillo northeastward, highways radiate through the San Miguel and Sonora River valleys, and over the plains and hills to the east and southeast are reached portions of the Moctezuma, Ures, and Hermosillo districts, as well as Sahuaripa. From Ortiz a highway leads eastward to La Dura and other points beyond, while from Empalme the new Yaqui River railway starts out to open up the mines and coalfields along this well known stream. Alamos will also be reached in this way by January 1, 1908.

From Cananea, which is soon to be connected with Nogales by railway, the Sonora River valley opens southward; this is an important thoroughfare, crossed by the Sonora railway at Hermosillo, with rich farming lands along the stream, and mines in the hills on either side.

From Nacozari the valley of the Moctezuma flows southward to unite with the Yaqui, while over a short divide to the southeast the valley of the Bavispe leads, by its headwaters and tributaries, to the north and east and by the main stream south to the Yaqui. It may be noted here that none of the rivers of Sonora are navigable, except the Yaqui in its lower portion.

As mining is dependent on supplies of food for man and beast it is appropriate to say a word on agriculture. This industry is at present chiefly confined to the river bottoms, and their possibilities are very great. The ranches produce large quantities of wheat, beans, and corn, the staples of consumption, beans being the chief food of the Mexican laborer. Barley and alfalfa are extensively grown for hay, and a small amount of cotton is produced. Vegetable gardening is practiced on a small scale by Chinese, but no great variety of fruit raising has been attempted, though at Magdalena and Santa Ana are produced many peaches, quinces, and pomegranates, and oranges grow luxuriantly wherever planted, notably at Hermosillo and Ures.

The unequal distribution of rainfall throughout the year necessitates irrigation in the dry season, which extends with only occasional rains from October to June. The Mexican laborer has intuitive or inherited skill for such work, excavating *acéquias* or irrigating ditches, for long distances, without surveying instruments, and giving the necessary attention to the flow of water with efficient results and little apparent effort. On the river bottoms the expense is nominal, as a supply of water is near, while the irrigation of desert lands would involve questions of storage and cost, similar to those which arise in Arizona and California.

In consequence of the slight rainfall and the high evaporation, there are few permanent streams. The rains, limited mostly to the summer season, fall with great violence and cover the ground with water which does not at first form rills or brooks, but flows in sheet floods to lower levels. The accumulation of this flow gathers in *arroyos* or stream gulleys which, extending for miles as temporary conduits, ultimately discharge into some river which carries the drainage to the gulf. There are four such drainage systems in Sonora; the Magdalena, the Sonora, the Yaqui, and the Mayo.

Copper, gold, and silver are the chief metals of Sonora. Lead is of limited occurrence in association with silver and gold. Iron is known in Alamos, but the deposits are not yet developed. Antimony is mined in western Altar. Coal is of somewhat wide occurrence in the region of the Yaqui river, but is not yet mined for shipment. Graphite of good quality has been mined in Hermosillo, near Willard. Deposits of carbonate of soda and borax are also known in western Altar.

The following list of some of the better known mines of the State will give a general idea of its mining industry. Many of these have been visited by the writer and the data regarding others have been taken from sources believed to be accurate. No one, however, can enumerate the myriads of abandoned *antiguas* which, in the past, have yielded a rich harvest to the early miner, and which, in many cases, only need capital and intelligent development to make them again richly productive:

In this list the mines are discussed by districts according to the official classification.

ALTAR.

This district, which lies west of the Sonora railway, is the largest division of Sonora, and yields chiefly gold and copper. Its western part is a coastal plain of low altitude with stumps of eroded mountains projecting above the general surface. It is rich in gold-bearing veins and especially in placers, most of these being local accumulations of detrital material from the decay of veinstone and impregnated rock. The district was known for the great extent and richness of these deposits long before the Spanish occupation and, in its numerous gold-bearing veins some rich mines were developed, a few being still in operation. Altar is the most arid region of Sonora, and mining is greatly hampered by the scarcity of surface water; yet that obstacle is frequently overcome by pumping from wells or rivers. In the early working of the placers, millions of dollars were taken out without the aid of water, by the *batea*, or wooden gold pan, the natives being very expert in the use of this implement. The introduction of the dry washer from Hungary in 1851, has greatly facilitated the extraction of placer gold. These machines, of which various kinds have been devised, combine air-blast and agitation, the air from a bellows or rotary blower passing through the cloth bottom of an inclined table crossed by wooden riffles, down which the auriferous earth is made to travel by constant agitation. The blast carries away the dust and the gold is caught by the riffles. Dry methods can, of course, be pursued only in the dry season, when the

ARIZONA
CHIHUAHUA
ALTAR
MADALENA
ARIZPE
MOCTEZUMA
URES
HERMOSILLO
GUAYMAS
ALAMOS
SAHUARIPA
GULF OF CALIFORNIA
BAJA CALIFORNIA
Tucson
Benson
Tombstone
Douglas
Nogales
Naco
Bisbee
Fairbanks
Cerro Colorado
Oro Blanco
Washington
Sierra Pinta
El Plomo
Quitovac
Sasabe
Altar
Caborca
Calera
Sta Ana
Magdalena
Cucurpe
Arizpe
Bacoachi
Cananea
Fronteras
Nacozari
Agua Prieta
Cibuta
Oquitoa
Imuris
Tubutama
Sasabe
Juarez
Mina Grande
El Tiro
Cienega
Cerro Cajon
Puerto
Tuape
Querobabi
Opodepe
Rayon
Carbo
Pesqueira
Ures
Baviacora
Sinoquipe
Aconchi
Huepac
Arispe
Oputo
Promontorio
Lampazas
Batuc
Suaqui
Nacori Grande
Hermosillo
Guaymas
Batamote
Navajoa
Alamos
Quintera
Los Pobres
Pedras Verdes
Tesia
Baucari
Cedros
Tonichi
Trinidad
La Bufa
La Tayopa
Mexico
Colorado
Llano Colorado
Zubiate
Tarrasca
Minas Prietas
Amarillas
Torres
Laguna
Williard
Grande
Italia
Chipiona
El Cobre
Sonora Queen
Sonora Chief
Sto Nino
Cacanora
Ahuaripe
Yecora
Churumbabi
Square and Compass
Pilares de Nacosari
Los Picachos
Barranca
Tigre
Bacerac
Yecatsura
Transvaal
Sta Elena
Picardo
El Socorro
Opodepe
Asconchi
Felipe
Sta Rosalia
Rey de Oro
Tucabe
Londyke
Cerro Prieta
Sta Barbara
San Francisco
Llano
Las Dos Naciones
Animas
La Republica
La Brisca
La Cubana
Sta Rosalia
Lluvia de Cobre
Verde Grande
Tiburon
Isla Tiburon
Sta Rosalia
Baja California
Sierra Madre
Sierra del Viejo
Sierra de Pinacate
Sierra de Cocoraque
Sierra de Cobachi
Sierra de Los Ajos
Sierra de Nacozari
Sierra de Sta Rosa
Sierra de Bacatete
Sierra de Oputo
Sierra de Tecoripa
Sierra de Opodepe
Sierra de Tuape
Sierra de Cuchuta
Sierra de Pinacate
Sierra de Tubutama
Sierra del Carmen

dirt is free from moisture, artificial drying being as yet not in use.

This district is richly mineralized, except, possibly, in a belt about 50 miles wide along the coast from Libertad southward. Within this area few mineral deposits have yet been found. It is, however, a desert without surface water, and this important article must be carried by the traveler, both for himself and for his horses or mules. It is possible that, when more wells have been established, and mere existence becomes less of a problem for the prospector, many good orebodies may be found in this coastal plain.

Altar, the capital of the district, with a population of 1,400, is about 50 miles west from Santa Ana. Nine miles farther west is La Cuchilla, where the Rey del Oro Mining Co. had a gold property with three Huntington mills. Near La Cienega, about 60 miles southwest of Santa Ana, are extensive placers. Over thousands of acres the ground is honeycombed with shafts and drifts where the pay-dirt was reached and brought to the surface for the separation of the gold by dry panning. This region was, however, worked over again by dry washers from 1884 to 1894, 10,000 people being employed. Part of the gold of this region is in a gravel, cemented with some degree of firmness and requiring mechanical treatment by stamps or otherwise to release the precious metal. Sometimes, however, this cement gravel can be broken up by wetting and exposiug to the sun and air. About seven miles northeast of La Cienega are the placers of La Yaqui, El Tiro, El Cajon, Cerro Colorado, Los Llanos, San Francisco, and La Sierrita, which have been worked intermittently for a long period.

In quartz mining also the region has been noted. The Tiro vein has been traced a long distance. At El Tiro, the north extremity, the Reina de Oro Mining Co. has sunk several shafts and is operating a 20-stamp mill. At El Cajon de Amarillas the Yerkes Gold Mining & Milling Co. has bodies of gold ore ready for stoping and a new 20-stamp mill. Cerro Colorado, between La Cienega and El Tiro has been worked for years, following rich streaks and stringers of gold ore, which was at first reduced in a small stamp-mill near La Cienega and later on by Huntington mills at the mine.

About 35 miles northwest of Magdalena is Tubutama, where the Juarez Mining Co. is developing a copper property. This company also owns the Juarez gold mine 30 miles northwest of Caborca. This is an *antigua* which was long worked as a placer by Papago Indians, who have found some large nuggets in the vicinity. In 1902 one was sold weighing 38.8 oz. The merchants of Sonora purchase placer gold from the Indians at about P26 per ounce. Its fineness usually ranges from 860 to 900.

A vein on the property was developed and worked in 1891 by a San Francisco company, which erected a 20-stamp mill with pan amalgamation. This process was not adapted to the work and a cyanide plant will be installed by the new management.

Thirty-six miles northwest of Caborca beyond the Juarez is the Palomas placer field. At La Calera, nine miles west of Caborca, the Arizona-Mexican Copper Co. of Phœnix is developing El Gran Proveedora de Cobre, a copper property on which development to the depth of 500 ft. has revealed extensive orebodies. Another copper mining company, the Ohio-Mexican, has also been operating near here with a 60-ton smelter.

On the Gulf coast near San Jorge Bay and at Quitovac, the Sierra Pinta Mining Co. has in operation two gold properties connected with the reduction works at San Jorge Bay by 13 miles of narrow-gauge railway. East of Sierra Pinta, at El Plomo and San Francisco, are important gold properties and some copper prospects are being developed. The Sombretillo is near the Arizona line. Near Cobota also are some copper prospects of good promise. An important area of new mines is in the vicinity of the Ranch of Las Animas, near the southeastern corner of the district and about 15 miles west of the railroad. Many promising prospects are being developed here.

This region was the chief source of the great supply of gold which during the Spanish occupation poured across the Sierra Madre to the viceregal court at the City of Mexico and thence to the royal treasury of Spain. Before that time, it supplied much of the gold that the Aztecs accumulated and which was wrung from them by the *conquistadores*.

In the southeast corner of Altar, on and near the ranches known as Las Animas and Las Rastras, is a group of mineral veins yielding lead, silver, gold, and copper. No large mines have yet been developed but active work is being prosecuted in a number of camps. Prominent among these are Las Animas, La Compañia, La Valedora, El Aguila de Oro, and Republica del Sur.

MAGDALENA.

East of Altar is the Magdalena district, containing a number of historic mines of the Spanish occupation. One of the most interesting of these is the Planchas de Plata, about 12 miles southwest of Nogales. The ore here is a quartz-porphyry conglomerate carrying horn silver.

About six miles north of Planchas are the Promontorio mines, owned by parties at Nogales. The ores are sulphides of lead and copper carrying gold and silver. Twenty-seven miles southeast of Nogales is the new Santa Cruz Copper camp, with veins of chalcopyrite, on which W. C. Greene and others have recently denounced a large number of claims.

West of Cibuta on the Sonora railway are the Guacomea mountains, in which some mining has been done. About 12 miles east of Quijano station and 30 miles southeast of Nogales in the Pinitos mountains, is the property of the former Hays Mining, Milling & Lumber Co., now in the hands of the Columbia Consolidated Mining Co., consisting of 50,000 acres of timber-land with veins of copper, gold, and silver. On the eastern slope of these mountains is the Buenaventura Mining Co. East of the Pinitos Mts., in the Cocospera valley, are the ruins of an old Mission church of that name, with vestiges of a large settlement and slag-dumps, which show that the place was once the site of large operations. On either side, in the Sierra de Pinitos or in the Sierra Azul to the east, are old mines whence came the ores reduced at the smelters. The Sierra Azul Mining Co. has developed a good orebody in one of these. At the mouth of the Cocospera river, where, by its junction with the Alisos river, it gives rise to the Magdalena, is Imuris, a small village built on a high terrace. Four miles west is the property of the Superior Bonanza Mining Co. of Calumet, Mich. This property has been partially developed and shows promising bodies of oxide and silicate ores carrying gold, silver, lead, and copper, as well as the mineral wulfenite, which is rare in this district.

Some six miles north of Imuris, on the mountain known as Cerro Blanco, is the gold mining property of the same name, long ago partially developed and recently under examination by British capital which will probably take it up for further development. From Imuris the Sonora railway follows the Magdalena valley past the city of that name, 50 miles from Nogales. With 3,500 inhabitants, it is the capital of the district and the centre of an active trade with rapidly developing mining regions and a rich agricultural district along the river.

Thirty miles southeast of Magdalena the Dolores and Santo Domingo rivers unite to form the San Miguel. Above the junction, in the Santo Domingo canyon, is the placer goldfield bearing the name of the river, and farther up the stream is a similar deposit at La Brisca. Both of these are held by the Greene Consolidated Gold Co. They were formed by the erosion of gold-bearing veins in the ranges surrounding the river valley, known as the Caliche, Sierra Azul, and Santa Rosalia mountains, forming a natural basin drained by the river. In this region are also several *antiguas*, in particular the Cerro Prieto, Caliche, Rey del Oro, Klondyke, and Tucabe. The Cerro Prieto property is extensive, with a large body of low-grade gold ore, opened by a series of adits connected by winzes through which the ore is brought down from the upper levels to the lowest, and thence transported to the mill. The latter is large, and the first unit of 120 stamps has lately been installed. The mine and mill are operated by electric power from a new plant at Magdalena. Water for the mine is pumped three miles from the Santo Domingo river. This property is operated by the Black Mountain Mining Co., of Chicago.

Seven miles northeast of Cerro Prieto is the Providencia gold property. Beyond this is the Caliche, a low-grade gold proposition bonded to the Greene Consolidated Gold Co. Beyond the Santo Domingo river eastward, 12 to 15 miles from Cerro Prieto, are the Tucabe and Klondyke mines. The Tucabe operates a 15-stamp mill. Near the Klondyke is the Rey del Oro, an *antigua* with extensive workings.

On the San Miguel river, at the junction of the two streams which unite to form it, is Cucurpe, the site of an older settlement of some importance during the Spanish occupation. Ten miles west of Cucurpe is La Higuera, an old camp with ruins of many *arrastres*. The property is operated by the Brady-Levin Co., of Nogales. Southward along the San Miguel valley there are mineral veins in the mountains on either side and westward toward the railway are the Santa Barbara, Soledad, Otate, and other camps with many *antiguas*.

About 15 miles west of Llano, on the edge of the Altar district, is the mountain country of the Rastras Ranch with many mineral veins. Near Llano station is the San Francisco mine, a gold property with a 10-stamp mill and a cyanide plant for treating the tailing, which was in operation for many years but is at present idle. Las Rieles is another property in the neighborhood. West of Llano three miles is a dry placer. The Libertad is a new gold mine operated by the Llano Gold Co. three miles northwest of Llano, while 10 miles southeast is the Caracahui range, in which are the Llano Copper Co. and the Sonora Copper Co., both actively engaged in development work. About 30 miles southeast of Llano is the Soledad mine, an *antigua* owned by W. C. Greene.

ARIZPE.

The Arizpe district adjoins Magdalena on the east and is drained by the Sonora river. About 50 miles southwest of Bisbee is the copper camp of Cananea, where the Greene Consolidated Copper Co. in seven years has developed one of the greatest copper properties in the world. The production of the district in 1906 was 18,108,640 lb. refined copper. Cananea supports a population of 23,000 and is the largest camp in Sonora. Ten years ago there were not 500 people in the region. Besides the Greene company a number of others have sprung up around it, there being in existence at present the Democrata Mining Co., of Cincinnati, the Indiana-Sonora, controlled by Phelps, Dodge & Co., the Cananea-Duluth, and the Cananea Central, which has recently been united with the Greene Consolidated.

Arizpe, the capital of the district, is on the Sonora river, about 75 miles south of the national boundary, and was a place of much prominence during the Spanish rule. It is now a town of 1,400 inhabitants, though once said to have contained 35,000, and shows the ruins of dwellings, churches, and other buildings, covering a large area. Vestiges of old furnaces and slag-dumps bear witness to former metallurgical operations. This city was in 1804 the seat of government of the Intendencia de Sonora, which included the provinces of Sonora and Sinaloa. About 1823 the seat of government was transferred further down the Sonora river to Ures, once also a city of wealth and commercial prosperity. Here, in turn, the changes in commercial conditions made it advisable to transfer the State capital to a more accessible point and it is now at Hermosillo. North from Arizpe and west from Bacoachi is the Picacho gold mine. In the vicinity of Bacoachi are extensive placers, and northward, in the Ajo mountains, are several new copper prospects, notably that of the Cananea Eastern Mining Co., about 20 miles east of Cananea. Fifteen miles west of Arizpe are the Santa Rosalia gold mines of ancient fame. Ten years ago these were re-opened by a California company, which afterwards sold to George Mitchell. The property is now idle.

Fifteen miles southeast of Arizpe, near Bavicanora, is the famous Las Chispas silver mine and near it the Carmen mine, which has recently been re-opened. Farther down the river, near Banamichi, is the Santa Elena mine, once operated by General Pesqueira. Later it passed into the hands of an English company, but it is now idle. Eight miles below Banamichi is Huepac, where a Milwaukee company is operating a small reduction plant. There are myriads of old mines and new prospects in the Arizpe district, but few companies are as yet operating there.

MOCTEZUMA.

East of the Arizpe district is that of Moctezuma, which is bounded on the east by Chihuahua. At Nacozari is a great copper property connected by a branch line with the El Paso & Southwestern Railway at Douglas, 80 miles distant. It is under the control of Phelps, Dodge & Co., who operate the Copper Queen at Bisbee, the Indiana-Sonora group at Cananea, and the mines at Globe and Morenci. The concentrate from Nacozari is shipped to the smelter at Douglas.

In the Huacal region, east of Nacozari, are many famous *antigua* mines, such as the Huacal, Doña Maria, Churunibabi, and many more. Northeast of Nacozari, 60 miles beyond the Bavispe river, is the Pilares de Teras region where are the Cinco de Mayo and Roy mines. Not far away is El Tigre, a recent discovery, rich in gold and silver. Two or three miles farther, and nearer Pilares de Teras, are the San Juan mines. In the southern part of the district, at Lampazos, there is a silver property with a long record of rich production. The ore is treated by lixiviation. In the vicinity are many *antiguas*. Copper mines of some promise are found at Transvaal and Promontorio.

URES.

The Ures district is one of the richest in the State and the list of its mines begins at the north, in the valley of the San Miguel river where the latter leaves the Magdalena district. Eastward from the town of Tuape are the extensive copper properties of the Richfield Mining Co., upon which development work has been actively conducted. There are other old mines and prospects in this vicinity. Westward toward the railway is the

Querobabi region in which are a number of promising gold properties. Farther down the San Miguel valley, west of Opodepe and east of Poza station, is the San Ricardo, a gold mine with a record of rich production going back to ancient days. Twelve years ago it was operated by an American company, which erected a 20-stamp mill and shipped gold bullion. Detected in smuggling gold out of the country, the property was confiscated by the Mexican Government. The mill fell into ruin and later the claims were taken up again and sold to a Canton (Ohio) company, which has begun development and erected a mill.

Several miles west of San Ricardo is the Mina El Oro, operating a Huntington mill and shipping bullion. The Santa Gertrudis is another good property near-by. In the same vicinity is the Amarillas, a silver property with a good record. Six miles south of the Amarillas is the Socorro, which also has a good record of production. In the same region are the Nopalera, Tortuga, and others. From San Ricardo and El Oro on the north to Nopalera and Socorro on the south, an area about 6 miles by 16, the country is cut by numerous veins that show gold and silver in the croppings. A few leagues farther down the river from Opodepe is Rayon, the centre of another important mineral belt in which is the copper property of the Palo Alto Mining Co. Below Rayon is the San Francisco gold mine. Southwest from Rayon about seven miles is the Copete district, where the Copete Mining Co. has large holdings and a smelting plant of 250 tons capacity. Adjoining the Copete is the Sultana property of the Giroux Consolidated Mining Co., one of the important mines of Sonora. A shaft is down 1,050 ft. in rich oxidized ore carrying copper, lead, gold, and silver. Within three years, large shipments of rich ore have been made to the smelter at El Paso. South of the Sultana is the El Colorado property of C. S. Mills and associates which is said to contain large bodies of low-grade gold ore. North of the Sultana and Copete properties is that of the Beleu Mining Co. with headquarters in Chicago. This Copete district is characterized by strong evidences of extensive mineralization and there is every reason to expect the development of some extensive orebodies. The camp is supplied with water by a pumping station at Rayon.

In the valley of the Sonora river, about 25 miles southeast of Copete and 12 miles southwest of Ures, is the Gavilan region, prominent in ancient days. Here the Ures Consolidated and the Vega Mining companies are operating, the former with a 10-stamp mill. A few miles farther up the river the Coches Mining Co. is developing a gold property.

The city of Ures, the seat of government in this district, is 56 miles from Hermosillo and has about 2,000 people. To the southeast, toward the Matape river, are the Chipiona and Colorado-Ures camps, a few miles northwest of the town of Matape. Ten or twelve miles south are the Marquesa and Quincy mines. Fifty miles southeast of Ures near the edge of the district is the Llano-Colorado region, famous for its placer diggings more than a century ago. A few miles west are the Realito mines where extensive old workings and the traces of many *arrastres* tell of active mining in former days. From the Los Angeles mine silver ores have recently been shipped.

Twenty miles northeast of Matape and about 60 miles from Minas Prietas is Suaqui de Batuc, near the confluence of the Moctezuma and Yaqui rivers. The former comes from near the Arizona line, nearly 200 miles north, and the Yaqui or Aros flows from Chihuahua on the east, turning at its junction with the Moctezuma and flowing south. Along both rivers are rich mineral regions. Southeast of Suaqui de Batuc in the Sahuaripa district, are the Santo Nino mines once owned by the Yaqui Copper Co. In the vicinity of Suaqui de Batuc are also Todos Santos, El Cajon, Zaragoza, Estrella, and other properties, several in course of development. Near Batuc, about two leagues above Suaqui, is the Lista Blanca mountain, where a network of silver veins ramifies to considerable depth and has been worked almost continuously for two centuries. There are also deposits of copper and quicksilver in the same mountain. The Tonichi copper property, owned by the Trimetallic Mining Co., is about 10 miles east of the Yaqui river, and coutains a vein of copper ore with gold and silver.

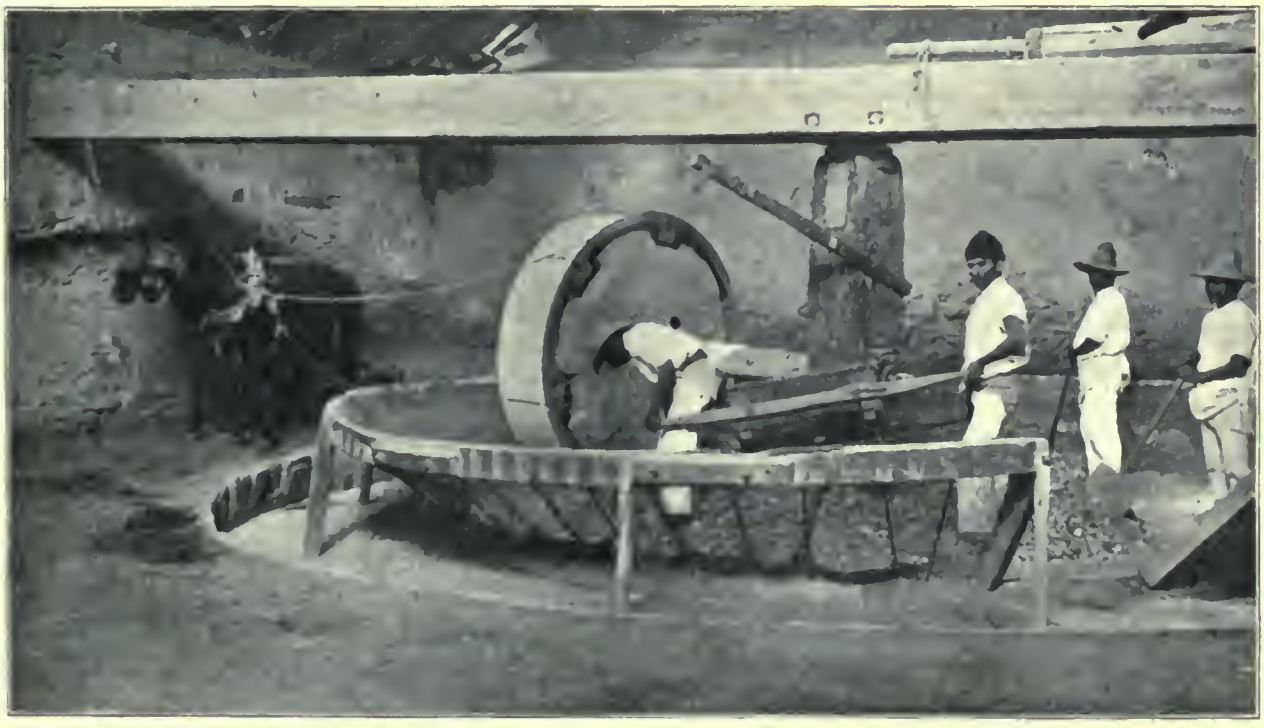
HERMOSILLO.

South of the Ures district is that of Hermosillo, in which is the important mining camp of Minas Prietas, about 35 miles southeast of the city of Hermosillo and 12 miles from the Sonora railway at Torres, with which it is connected by a narrow-gauge line. Two large properties are operated here, the Creston-Colorada and the Grand Central, and until the development of Cananea this was the largest camp in Sonora. The region was one of *antiguas*, some of the mines, including the Colorada, having been worked more than a century and a half ago by Jesuit missionaries. Depredations by Indians are said to have compelled their abandonment. About the beginning of the nineteenth century the Prietas and other properties were worked with good results by miners who had been attracted by reports of former success. After a second abandonment, on account of water, they were idle for many years. About 1860 several of the old mines, including the Creston and Prietas, were re-located by Ricardo Johnston, a man prominent in the mining history of Sonora. The two properties mentioned were pumped out and worked with profit for a number of years. The Prietas was then sold to an American company, which built a 40-stamp mill and operated successfully until operations were stopped by a fire in the shaft. In 1886 these holdings and others were taken over by the Creston-Colorada company, of Cleveland, Ohio. Subsequently the control of this corporation passed to a syndicate headed by John W. Gates. This company owns the Prietas, Fortuna, Creston, Colorada, Don Ignacio, and other properties extending a mile or more along the wider vein. The Creston, Fortuna, and Prietas are at Minas Prietas and the Colorada and Don Ignacio at La Colorada, a part of the same municipality about a mile away. Here is the mill of 30 stamps, six Huntington mills, nine amalgamating pans, and 16 Frue vanners, with a daily capacity of 200 tons. The tailing is treated by cyanidiug. The mill is connected by a wire-rope tramway with the hoist at the Creston shaft 1,100 ft. deep, through which is raised the ore from the Fortuna and Creston mines. About 1890 rich orebodies were developed in the Grand Central, Amarillas, and other properties on a vein parallel to that in which all former successful operations had been conducted and another great enterprise was launched. In a part of the camp known as La Primavera, adjacent to La Colorada, are the Grand Central and Amarillas mines, owned by the Grand Central Co. and leased to the Charles Butters Co. The ore from these mines goes through the stamps and Huntington mills, and from the latter to the large cyanide plant, which employs the Butters electrolytic process of precipitation and has a daily capacity of 400 tons. The ore is said to run from $5 to $7 per ton.

In the spring of 1907 the Butters Co. took over the control of the Creston-Colorada properties, so that the whole camp is now under one management. Water for the mines and mills is supplied from the Matape river, 20 miles away, by a pumping plant at San José de Pimas.

There are other properties in the Prietas district that promise well and may, with development, become productive. Between Prietas and Hermosillo are the Dewey, Mina Grande, and several other mines. Twelve miles north of Minas Prietas is the Zubiate district, where are several silver mines with good records of production in former days. North of Zubiate and east of Hermosillo are the Tortuga, Constitution and Italia, Last Chance, Santa Rosa, and Las Cruces. About 12 miles west of Torres are the mines of the Tarrasca Mining Co. This is another *antigua* camp. Five miles east, at Aguage, are vestiges of old *arrastres* and many tailing piles, showing that much ore was treated there in the old days.

From Minas Prietas eastward, roads lead to all points along the Yaqui river, about 100 miles away. Beyond this, in the Sahuaripa and Alamos districts, lies one of the most important mineral regions of Sonora, which in old days was one of the best in New Spain. West of the river, also, in the Hermosillo and Ures districts, are extensive mining regions with historic records. Among



Grinding Ore in a Chilean Mill, in Mexico.

these are the camps at San Javier, La Barranca, Los Bronces, San Antonio de la Huerta, Las Goteras, Cerro Colorado, San Juan Grande, and Soyopa. At San Javier the Gold Coin Mining Co. has a 30-ton copper smelter. This company also owns the Santa Rosa, a well-known *antigua*. At the same place the Wyman Mining Co., operating the Animas mine, has erected a 50-ton concentrating plant. The Verde Grande is a copper property near San Javier. At Toledo, on the west bank of the Yaqui river, the Yaqui Smelting & Refining Co., of Toledo, Ohio, has established a custom smelter, having a 100-ton lead stack and also a copper furnace. Near Suaqui Grande, on the Tecoripa river, the Chicago & Sonora Gold Placer Mining Co. a few years ago installed a gold dredge and operated with some success. This placer field is about 30 miles long, extending along the Tecoripa river from Suaqui Grande to its junction with the Yaqui at at Cumuripa. There is also a placer field along the Yaqui river, in which a dredge was operated by Milwaukee people. Northwest of Hermosillo about 40 miles are some copper properties, notably the Verde Grande, the Lluvia de Cobre, and El Mohin. The first of these has a 100-ton smelter. Near the Gulf coast in the Bacoachi region are other copper deposits now under development.

SAHUARIPA.

East of Ures and Hermosillo and south of Moctezuma, the Sahuaripa district was one of the great centres of metal production in early Spanish days. It contains the Trinidad, La Bufa, Mulatos, Cieneguita, Tayopa, Ostimuris, Tejada, and many other noted mines, which, according to the Spanish records, yielded a large output of metal during nearly two centuries.

A day's ride east of Tonichi lies the region of La Bufa and Trinidad. Within 20 miles are over 100 *antiguas* that have, in early days, been large producers and promise good returns with the intelligent use of capital. .

The work of the Bufa Mining, Milling & Smelting Co. illustrates the possibilities. Seven or eight years ago a few practical miners from Minas Prietas and La Dura took up the *antigua* known as La Bufa. They sunk a new shaft and at a depth of 300 ft. reached the orebodies formerly worked at higher levels, and, continuing to a depth of 600 ft., they opened a body of high-grade ore, which stood the cost of transportation 150 miles on mule-back to Torres and thence by rail to El Paso. The lower-grade ores were concentrated and also shipped. A 35-ton smelter was then erected and matte made on the ground.

About 10 miles distant are the Trinidad mines, once famous as silver producers. The parties who opened La Bufa have purchased the Trinidad and are pushing development work with promising results.

A day's ride northeast of Trinidad are the Mulatos gold mines owned by the Greene Gold-Silver Co. North of Trinidad are the properties of the Cieneguita Copper Co., including the Chipiona-Cieneguita, Ostimuris, and Tayopa. These are all *antiguas* with high records of production in gold and silver. Two 10-ton reverberatory furnaces are in operation. Near Trinidad are outcrops of a Triassic coalfield.

ALAMOS.

Adjoining Sahuaripa on the south is Alamos, noted in

the history of New Spain for its production of silver. At the city of Alamos was a branch of the Public Treasury, and from it were sent out the *conductas* of hundreds of mules laden with gold and silver ingots that traversed the Sierra Madre to the City of Mexico, whence the treasure was sent to Spain. West of Alamos city is the Quintera mine, once a rich producer, and the source of great wealth for the Almada family. The property still continues in operation under a French syndicate, and is worked to a depth of 1,500 ft. An extensive iron deposit occurs about 50 miles northwest of Alamos, near the village of Cedros. At Baucari and Trigo are gold quartz mines. At El Cerrito are placers, and at Baroyeca and Piedras Verdes are deposits of copper ore.

In the extreme north of the district is La Dura, about 80 miles from Ortiz on the Sonora railway. Here are extensive deposits of copper and silver. At Batamote, 15 miles south of La Dura, the Ruby Gold & Copper Co. operates a copper mine, reducing the ores in a reverberatory furnace.

GUAYMAS.

Southwest of Sahuaripa is the Guaymas district, through which passes the road from Ortiz to La Dura. There is considerable mining here and many rich deposits are known, but the Yaqui Indian trouble has retarded development. At San Marcial are extensive coal measures of Triassic age. The field extends northward into the Hermosillo district, where parts of the deposit, altered by volcanic action, have been mined for graphite. In the Bacatete Mts., southeast of Guaymas, is the Bonancita region, with veins of auriferous quartz and numerous placers. At La Barranca, six miles from Toledo, is an extensive deposit of anthracite and natural coke, controlled by the Southern Pacific Railroad Company.

GENERAL.

Although its mineral wealth was known of old, Sonora was practically shut to the miner for nearly half a century after the close of the revolution against Spain. This was due to the depredations of the Apache Indians who, after the Mexican troops retired, ravished this Southwestern country. It has indeed been truly remarked that for a long time Sonora was under the Apache government rather than that of Mexico. After the purchase by the United States in 1853, under the Gadsden treaty, of the territory south of the Gila, southern Arizona was somewhat protected by soldiers till the beginning of the Civil war when, on the withdrawal of these troops, the savages overran many of the white settlements. The region remained subject to their depredations and largely closed to commerce till after the completion of the Southern Pacific railway. This greatly facilitated the transportation of troops, and the capture of Geronimo soon followed in 1884. From that time dates the opening of Sonora to the modern miner.

The production of copper in Arizona in 1906 reached 263,200,000 lb., that is, greater than that of Michigan, 83% of that of Montana, and 28% of the total product of the United States. The question arises, to what extent the supply may be increased from the region just over the border of Arizona?

In Sonora this metal is so frequent in occurrence that we may expect a rapid expansion of production beyond the present large output of the great mines of Cananea and Nacozari, which in 1906 reached the imposing figure of 61,000,000 lb. Other smaller camps produced an aggregate of about 1,000,000 lb. more, thus making a total of about 321,000,000 lb. copper for Arizona and Sonora, against 315,000,000 lb. for Montana.

The copper zone of Sonora is the southward continuation of that of Arizona, and extends over nearly the whole State. Deposits of this metal occur rather frequently in all the districts, except Guaymas.

As in Arizona, so in Sonora, the principal copper orebodies are in limestone or associated with it, and, in turn, are in close relation to masses or dikes of eruptive rock, which contains copper or has stimulated the flow of a copper-bearing medium.

While the presence of green stains of malachite and dioptase on quartz veinstone has led, in many places, to the expenditure of much time and money in the attempt to make copper mines, it seems established after many trials that no one has yet succeeded in developing a substantial copper mine on a quartz vein in Sonora. In some of the silver mines, tetrahedrite occurs in quartz and from this copper comes as a by-product with the silver, but the large copper producers are all, or near, lime-porphyry contacts.

Quartz veins in Sonora, as elsewhere, are not always productive of the precious metals. Many large quartz veins are quite barren, although deposits of commercial importance are often found in the country beside the vein. Further, many of the largest and most productive orebodies contain very little quartz. Most of the large veins carry copper, lead, gold, and silver. There are few mines of silver free from copper. Gold occurs in nearly all the copper ores, so that the copper mines are usually producers of gold. A notable exception is the Pilares mine at Nacozari. Gold also occurs to some extent free in quartz veins. These are chiefly in Altar. Iron pyrite and the copper sulphides carrying gold yield, by their decomposition, oxides, silicates, and carbonates which give up their gold to amalgamation in the *arrastre*.

The zone of oxidation in Sonora is generally, except on the steep mountain slopes, quite deep, and so few of the mines have been worked far into the zone of unaltered sulphides that it is too early to undertake a general discussion of the types of Sonora ore deposits.

It may, however, be stated as a result of the writer's observations that the predominant type is the impregnated shear-zone. This is a zone of shattered rock of greater or less width where fracture or faulting has occurred in a series of parallel fissures very close together. Through this fragmental material a metallizing solution has flowed, saturating the fragments to a variable extent with lead, silver, gold, copper, or other metal, but not carrying sufficient silica to form a district veinstone. Sometimes, local deposits of quartz are formed in the shear-zone, and these, when exposed at the surface, resemble true vein outcrops but do not continue far in length or depth, although there may be important bodies of ore beneath them. As might be expected, the metallizing solution appears to have usually taken a meandering course.

The orebodies are the record of a flow that has often divided in passing the less porous rock-masses, so that 'horses' are formed both along the vein and in its width. sometimes these 'horses' are not entirely barren but carry low-grade ore. The formation of large 'horses' along the shear-zone gives the effect of shoots or chimneys of ore that unite in depth. A peculiar condition, sometimes noticed, is the offsetting of the ore through the constriction of the zone of flow and its diversion in a lateral direction, to be succeeded after a distance by a widening again and the resumption of ore along the general course. The result of this is a deplacement similar to that which might result from the faulting of a fissure-vein. In the shear-zone, however, there is no marked fissure to guide the miner in determining geometrically the position of the displaced orebody. Exploration work alone will find it.

Progress in the Treatment of Gold Ore.

By Alfred James.

*It will not be possible for me to review the progress of gold ore treatment for this year in as detailed a manner as is usual, owing to these notes being written while traveling some thousands of miles away from my base.

Fine sliming and the treatment of slime is again the most interesting feature of the year's progress; even former exponents of coarse crushing are now converts to modern slime practice. From eastern Asia to West Australia and from South Africa to North America sliming methods are pre-eminent and have modified the other processes employed in the industry, such as crushing to tube-mills and the roasting of ores previously ground very fiuely.

Less has been heard this year of pans. Experiments in the Transvaal appear to have resulted in favor of tube-mills, and many more of them have been installed. With heavy stamps the Luipaards Vlei appears to have been able to crush 8.5 tons per head per diem, but in Rhodesia I am advised that 10 tons per head is being obtained in more thau one instance—crushing, however, to pans instead of tube-mills.

For the Rhodesian practice differs from that of the Rand. With their much smaller installations, pans are found to be more suitable and efficient, as being cheaper to install, forming more convenient units, and making less demand on power. In consequence, there are but few tube-mills operating in Rhodesia. The pans thus used are of the West Australian type.

But tube-mills have unquestionably been much improved. Linings now last longer and instead of having to stop a mill every three weeks or so for a week for a new lining, it is now possible to run for three to six months with a lining placed in position in from two to three days. Automatic linings such as those of the El Oro, where pebbles are supposed to fix themselves in rebates cast in iron liners, do not yet appear to have proved themselves entirely satisfactory, and changes have recently been made in the shape of the recesses, which have now their sides chamfered to each other. The use of quartz or other lode-matter to be crushed in place of imported pebbles has much increased, and this with the utilization of quartz and local chert or other hard rock in linings of the Barry or Brown type has materially reduced the cost of operating tube-mills. In Africa a mill is started with a charge of pebbles containing say up to 10% lode-matter, then in regular work it is found possible to reduce the daily feed of pebbles by 5%, adding rough lode stuff to balance until the daily feed contains only 10% of pebbles, the whole of the balance being the product of the mine.

It is in the treatment of the slime produced by tube-mills and other grinders that the progress of the year has been most manifest. The decantation process, which originated in Africa and which has so long survived there, has now had its day. Designed to treat material of low value at that time not amenable to any other method, it has resulted in profits being realized from material that otherwise must have run to waste. But the huge and expensive plant and low extractions must now give place to more automatic methods involving cheaper equipment and higher saving, and already such cyanide experts as J. R. Williams, W. A. Caldecott, E. J. May, and H. S. Denny have been looking into processes employed elsewhere, notably the Butters, Burt, Ridgway, and Merrill filtering devices.

In these notes of last year reference was made to the new Denny plants at the Meyer & Charlton and the New Goch. The Denny brothers severed their connection with these two mines shortly afterward, but in spite of their absence filter-pressing appears to be regarded as successful by the management, although much doubt has been expressed as to the wisdom of running cyanide solution through the mortar boxes. Mr. Geo. Albu has criticized this as making it difficult to obtain the assay-value of the mortar-box product, but I assume this point would not be regarded as serious if Mr. Albu were convinced he was obtaining a higher recovery of his gold. On the Rand, however, the Denny methods have not been followed. Rhodesia, on the contrary, having investigated the results, has had quite a small Dehne filter-press boom, plant after plant having been installed during the last year.

But undoubtedly filter-pressing, even with Dehne presses, must give way before the suction filters, of which so much has been heard in the past year. Cheap and efficient, the daily tonnage handled by vacuum-filters is increasing by leaps and bounds.

And of the various vacuum-filters on the market I must unhesitatingly refer first to the Ridgway. This differs from the filters of the basket type in being more rapid, working with thinner cakes, giving better washing, and emptying itself in more cleanly fashion (automatically) than the basket-filters. Working as it does with the whole cycle of operation complete in 60 seconds on normal slime, it will be seen that difficulties, such as keeping material on cloths during transit of frames or during emptying and filling of vats, are entirely avoided, while the washing of so thin a layer ¼ to ½-in. thick is much more rapid and complete than the washing of a cake of double or treble the thickness. The Ridgway is thus able to work with a much smaller area of filter-cloth for any given capacity.

During the year a 500-ton plant has been put into successful operation at the Great Boulder in West Australia, and I understand another plant of similar capacity has already been started. Plants of similar and smaller capacities have been erected (or are in course of erection) in Mexico, India, South Africa, and Eastern Asia. The official figures of the West Australian Chamber of Mines shows Ridgway to be working under expensive local conditions (such as purchased power, dear labor and supplies) for under 8 cents per ton treated; in Africa the costs should be little more than half this.

The Butters-Cassel filters has been installed widely in Mexico as well as in the Western States of America, not perhaps because it was the best vacuum type of filter—the recent published correspondence shows the pioneer Moore to be at least the equal, and probably the superior—but because it was pushed by a man of repute and of great energy who was recommending the best thing he could get hold of. But in the recent correspondence in the technical papers it appeared to me that the only parties writing in favor of the Butters-Cassel filter were those who were, or had formerly been, associated with Butters, whilst the Moore was recommended time and again by parties in no way associated with Moore, who had laid it down after investigation and who were apparently in no way connected—not even by paying royalties—to Moore or his associates. Certainly if the Moore process had been run with half the energy, experience, knowledge, and skill of the Butters, I cannot imagine the latter type of filter to be employed at all.

For it is obvious that the hoisting of a basket of frames is a much neater and better and quicker expedient than the pumping in and out of pulp and solution or wash, each successive charge being mixed with the residue of the previous charge, whether of pulp or of solution or of water, and it is within the knowledge of men

*See editorial paragraph.

experienced in slime filtration that the maintenance of a vacuum in a basket half immersed—or partially immersed for say four periods of ten minutes each during each cycle of operations—does not make for good results. The lower portion of the cake is being thickened by pulp deposit while the upper is cracking from the inrush of air, an unequal cake is formed, and the washing must be unequal, and there seems to be a great waste of water in discharging the cake after filtration. From the published correspondence it seems to be laid down without serious contradiction that the Moore is more accessible and open to inspection, and that it does more work for a plant of given cost or in a given time.

Further modifications of the basket-filter have appeared in the form of enclosed filters worked by pressure or vacuum, such as the Blaisdell, Burt, and Kelly. This form of filter is scarcely new, and when tried some years ago proved itself unhandy, liable to freeze or choke, difficult to wash thoroughly, and difficult to discharge—in a word, it seems to be an attempt to work in the dark. Of course, modifications of the standard immovable enclosed type are made; one runs the frame into a cylinder or runs the cylinder away from the frame; this makes the operation more accessible but so far does not appear to be as successful as the pioneer basket type.

Reverting, however, to filter presses, Merrill has at last got his big plant at work after three years' labor. It appears now to be working to nearly its full capacity—according to my recent information—and to be treating slime at a remarkably low cost. Advantage has been taken of every natural condition to make a successful working plant, and using static pressure to fill the presses and wash their charges, the Homestake costs are probably as low as any slime-treatment method yet put into practice. But my information is that with such a method the satisfactory treatment and hydraulic discharge of thick cakes in huge filter-presses is only possible with crystaline or granular slime and with a great waste of water. In a word, it appears that successful results may not be anticipated by the process on ordinary slime under ordinary economic conditions; the thorough washing of 4-in. cakes is feasible only with crystaline-granular or readily permeable slime.

The successful handling of slime has also directed attention to the solution of the gold contained therein. Last year I referred to the system of treatment based on feeding solution or wash-water at the bottom of a vat, the slime contents of which were in a state of gentle agitation, the idea being an overflow of clear solution containing the gold content of the charge. W. L. Holmes, of Mexico City (formerly in South Africa), brought this to my notice some years ago, but it did not appear to make headway. Bewick & Moreing were working it last year in West Australia, but evidently without commercial success, and this year Adair & Usher have been booming an apparently similar process in South Africa. Possibly some metallurgist at the Geldenhuis Deep, or elsewhere, may make something tangible out of the idea, but it looks as though the only result would be to call attention to the additional extraction obtained by the increased agitation of the pulp, and in this connection I have had reason to investigate the work of the Brown agitator.

This apparatus, introduced into New Zealand at the Komata Reefs, depends on the principle of the lessened specific gravity of a centre column into which air has been introduced at just such a pressure as will overcome the weight of the column of water at the point of introduction. There is no question of a jet of air circulating solution on the principle of the injector, but merely the physical lightening of the weight of a column by the displacement of a small proportion of the water by air. Brown uses long narrow vertical (cylindrical) vats, say 40 ft. by 10 ft., or 55 ft. by 15 ft., with a centre column of 1 in. diam. per 1 ft. of vat diameter. Into this central tube or column the air is introduced, and agitation is so effective as to lift stones at a minimum horsepower per ton. The power taken appears to be about 2½ hp. per 50 tons of charge, which is the slime content of a 40 by 10-ft. vat. By this method the advantage of the accelerating action of air agitation is obtained at a small cost.

The use of these vats has been offered to the Waihi—the manager of which speaks very highly of them—and Waihi Grand Junction in New Zealand, and a number have been installed in Mexico under the name of the 'Pachuca Agitator.'*

The progress of cyanide treatment for the silver-gold ores of Mexico has been one of the features of 1907. Chihuahua has been adopting cyanide with avidity, and Pachuca appears to be now coming into line. Of course, El Oro has done pioneer work, and Guanajuato has also been in the forefront. In almost every case the practice is similar. Tube-mill sliming and treatment of the slime at first by decantation, but now by filter. High extractions are claimed, but having regard to the natural refractoriness of silver sulphide ores—in some instances as at Chinacates associated with pyrite, chalcopyrite, galena, and blende—one is impressed by the necessity of having recourse to the most modern practice, whether for getting the silver and gold into solution or for recovering the solution from the pulp for precipitation of the precious metal.

There is but little new either in roasting or concentration of gold ores this year. Merton and Edwards still hold the field for roasting, and the many flotation processes applied to the zinc-lead ores at Broken Hill, such as the Potter, Delprat, De Bavay, Cattermole, and Elmore, do not yet appear to be successfully running at any gold mines known to me, although it is thought that the mechanical and metallurgical skill at the back of the Elmore process will bring it to the forefront during the coming year.

POTTER'S SULPHIDE TREATMENT.—Great satisfaction is expressed in Australia at the cessation of litigation in connection with the Potter process for the treatment of sulphide ores, the formal signing of the agreement between the litigant companies taking place at Melbourne recently. The details show that the Proprietary Company assigns to the Potter's Sulphide Ore Treatment Company, Limited, all the patents it holds in the name of F. M. Dickenson and G. D. Delprat, including those relating to the Delprat process. This is a formal conveyance of the rights, so that in future the Proprietary company will work under license from Potter's company. It will, however, pay no royalty, the consideration for the right to use the process untrammelled being £10,000. The Proprietary company will have full liberty to employ the process on all mines that it may absolutely own, but not to license anyone else to utilize it, the power to do that being vested completely in the Potter's company. No opposition will be offered by the Proprietary company to any amendment that the Potter's company may wish to make to its patents. Each side will pay its own costs in the litigation that has already taken place. This arrangement will prevent a further expenditure of many thousands of pounds in legal proceedings.

EXPERIMENTS prove that the addition of graphite to oil results in a lower frictional resistance of the surface lubricated than would be obtained by the use of oil alone.

*See MINING AND SCIENTIFIC PRESS of November 30, 1907.

Mexico. Progress in 1907.

Written for the MINING AND SCIENTIFIC PRESS
By C. A. BOHN.

Two months ago everything seemed to be upon a solid basis in Mexico; and all pointed toward continued prosperity in this Republic. Then all at once came the signs of financial trouble, money became tight, promising enterprises were set back, and working properties were closed, until only the best continued in operation, or a few large producers, which, by reason of their organization, must be kept running to meet fixed expenses. Under conditions such as these to review the year's work in Mexico is like writing the history of a devastating war.

The greatest collapse was at Cananea, in Sonora. The Cole-Ryan merger of the Cananea Central with the Greene Consolidated Copper Co., under the control of the former and with the name of the Greene-Cananea, was but little more than consummated at the beginning of 1907. L. D. Ricketts was placed in charge, and almost immediately a practical rebuilding of the entire plant was planned. At the mines the caving system had already been introduced, so that alterations for further economy had to be made elsewhere. Plans were drawn and work started to replace the two 2400-ton concentrating plants at the Cananea Central and the Greene Consolidated by one central plant with 10,000 capacity, wherein by gravity and every other means economy was sought, and several units were completed. At the smelting plant new furnaces each of 450 tons capacity were being erected to take the place of the old, and six of the eight furnaces have been completed. Now practically all this work has been stopped and of the 4000 men formerly employed only a few hundred remain. Of the other work at Cananea, the Phelps-Dodge Co. has continued the development of the Sierra de Cobre mine, reaching a depth of 800 ft. and finding a 70-ft. body of 7% copper ore in the lower limestone; as well as taking over the Indiana-Sonora properties, on which development work was being pushed. Before the collapse, the Lewisohns had purchased from Lindsay & Talbot the Cananea Nueva, comprising 1200 pertinencias north of the Greene-Cananea. Chas. M. Schwab had taken up the Cananea Western of 398 pertinencias nine miles west of Cananea and constructed a wagon-road to the property. Guggenheim & Thompson had purchased the Cananea & Bisbee; the Mitchells, the South Cananea; Cole, Lindsay, and Talbot, the Bonanza de Cobre; and Michigan capital, the Calumet & Sonora (which is not closed down as they have a good high-grade lead product), so it may be seen that the leading copper interests in the United States were acquiring holdings there as rapidly as possible. Eleven miles south-east of Cananea the Arizpe Development Co. was opening up its 6500 acres with three shafts and was contemplating the erection of an immense reduction plant. And 20 miles south of Cananea the Fay Cananea Copper Co., with Duluth capital, was developing some 3600 acres. At Nacozari, the Moctezuma Copper Co., a subsidiary of Phelps, Dodge & Co., has closed down its smelter, but has erected a 2000-ton custom concentrator, the product from which goes to Douglas, Arizona. In the Magdalena district 27 miles southeast from Nogales, the Black Mountain Mining Co., after several years of work on a low-grade proposition, has met with deserved success, and now is making good profits with the 120-stamp and cyanide mill. Into this region many of the discharged men from Cananea have migrated on prospecting tours. The Belen Copper Co., at Cumpas; the Anita Copper Mines Co., at Corcorit; and the Cienegulta Copper Co., in the Sahuaripa district north of Ures; all have their little smelting plants and are shipping high-grade matte. And at Fundicion, 150 km. from Guaymas on the Alamos branch of the Cananea, Yaqui River & Pacific Railroad, the Pacific Smelting & Refining Co., controlled by the Douglas Copper Co., is just preparing to start up its 250-ton smelting plant, completed in November, for the treatment of its own ores and for custom business. Though the Yaquis continue to give trouble in the eastern part of Sonora, the railroads are beginning to form a network through that region and will soon drive them out, but the northwestern portion of the State is practically without transportation and has scarcely been touched by the prospector.

At the beginning of 1907 Sinaloa, rich as it is in resources, both mineral and agricultural, had but 85 miles of railroad, from the coast to its capital of Culiacan, and a short distance out from the port of Topolobampo, the western terminus of the Kansas City, Mexico & Orient. This road, however, has pushed construction work along the Fuerte river, until the grade has reached almost to the Chihuahua line, near Guazapares, a distance of 130 miles; and the Southern Pacific's Guaymas-Guadalajara line has crossed the Sonora-Sinaloa boundary and has built about 25 miles into the latter State toward San Blas, on the Fuerte river, the junction point with the Kansas City, Mexico & Orient. Furthermore, the survey of the Durango-Mazatlan line has been completed, so it is quite likely another year will see this State with two lines crossing it from east to west and another its entire length north and south. This railroad building has made such a demand on the men and animals throughout Sinaloa that, with the exception of the silver mining at Cosalá and at Copala and the gold mining at Realito and Boleo, no mining of real consequence has been done. But with better means of transportation, Sinaloa's future is assured.

To the State of Chihuahua must be given credit for marked general progress. Nor is this surprising, for aside from being the largest State in the Mexican Republic, it has had the added impetus of the Kansas City, Mexico & Orient building across its entire breadth from northeast to southwest, and the erection of a large smelting plant at its capital, the city of Chihuahua. This plant has been practically completed during the year by the American Smelting & Refining Co., and would no doubt have been blown in before this had it not been for the inability to get sufficient fuel and the lack of assurance from the Mexican Central Railroad that the supply could be maintained. The plant is of 800 tons capacity, intended principally for lead, and is thoroughly up-to-date in the economical handling of materials, with belt conveyors to and from the sampling mill and over the ore-beds, movable platforms, electric charge-cars, automatic feed, and electric engines for handling the slag-pots. East of the city of Chihuahua, on the line of the new railroad, considerable development work has been done in the way of opening up copper and zinc properties near San Sóstenes station and in the Coyame district. In the old camp of Santa Eulalia, there have been opened up hundreds of thousands of tons of comparatively low-grade (10 to 15 oz.) lead carbonate and iron oxide ores, in the following properties: The American Smelting & Refining Co.'s mines, which are being equipped with electric hoists and whence an aerial tram is to extend to the company's smelting plant; the Chihuahua and the Potosi (large zinc bodies also in this property), which are controlled by the Grant B. Selden interests in New York, and have their own railroad from the mines to Chihuahua; the Santa Eulalia Exploration Co., of Los Angeles capitalists, where in 16 months development work on

its Buena Tierra claims over 250,000 tons have been blocked out; and the San Toy in which Chas. M. Schwab is heavily interested, and which has its tramway of 4½ miles to connect with its own spur from the Mexican Central railroad; together with a number of other smaller producers. This camp alone, without further development work, could keep the Chihuahua smelter going for many years. To the west of the city, along the line of the Chihuahua & Pacific railroad, the development work has been more in high-grade properties, unless we except the Calera. This property, near Miñaca, the western terminus of the Chihuahua & Pacific railroad, is commonly called the largest zinc mine in the world, and has an immense sulphide body running about 10% lead and 30% zinc, with a garnet gangue, on which water concentration proved to be of no avail. Dry concentration was then tried and it is here that the Sutton-Steele pneumatic table has had its first successful demonstration on a large scale, and the manager, C. M. Pringle, is satisfied that it is the only method for handling the Calera ore. After crushing to 20-mesh the ore passes through an air suction classifier and onto the Sutton-Steele tables, which yields a remarkably clean concentrate, running over 65% lead, 3 to 4% zinc, and 3% iron, the middling is stored, and the tailing goes to the Wetherill magnetic separator, whence is obtained a product running from 40 to 45% zinc. At present only three tables are in commission, but they will be added to, and Mr. Pringle states that each table when running properly has a capacity of 30 tons per day. I have dwelt at length on this work because it is as a milestone in the progress of mining and milling, as demonstrating a practical method for handling these complex sulphide ores.

West of Calera the Kansas City, Mexico & Orient railroad has been pushing south and west to connect with its line from Topolobampo, while W. C. Greene (of Cananea fame) has been most active, in extending his tracks to meet the others of the Rio Grande, Sierra Madre & Pacific coming south from El Paso, building wagon-roads (a permanent blessing to that part of the country), opening up the timber-lands of the Sierra Madre Land & Lumber Co., and developing the mines that have been acquired by the Greene Gold-Silver Co., though it is a question whether he has been successful in this, but it is to be hoped, nevertheless, that his "promises to pay," which are due next June, may be taken up before that time and that he may soon again be actively at work, for his enthusiasm gives a certain impetus to such work that is greatly needed in this country. Of the other more important developments west of Chihuahua, the Rio de Plata Mining Co., 100 miles beyond the railroad, in charge of D. M. Shanks, has in an incredibly short time completed its 25-stamp mill and is shipping a rich concentrate while storing the tailing for cyanide treatment later; the Dolores, in the Guerrero district, is shipping concentrate and cyaniding the tailing; the Waterson company, in the Ocampo district, has added cyanide to its amalgamation plant; the Republica, at Morris, two days beyond Ocampo, has made final payments on the property, has erected a 10-stamp mill, is shipping out concentrate and storing the tailing; the Pinos Altos mines have been again opened by Pittsburg capital (T. N. Barnsdall and associates); the Batopilas continues prosperous; the Palmarejo & Mexican is meeting with more success since cyanide has taken the place of amalgamation, and a power-plant on the river and an immense mill at the mine for the low-grade ores are under consideration. At the extreme western border of the State, near Guazapares, which is just at present more accessible by way of Topolobampo, the rich gold mines of the Lluvia de Oro and the Calabacillas are being provided with stamps and cyanide mills, while the former is being thoroughly equipped for electric power from a 500-kw. steam turbine. In the Parral and Santa Barbara districts, the most noteworthy work

Map of Mexico, Showing the States.

for the year has been the erection of the 80-stamp mill (for cyaniding) and the installation of electrical equipment on the properties of the Veta Colorada Co., controlled by Martin J. Coudon and associates of New York; the completion of the 200-ton mill (vanners and cyanide) of El Rayo Mining & Milling Co. controlled by W. B. Thompson, of New York; the successful termination of experiments on the ores of the Tecolotes y Anexas of the A. S. & R. Co., and the starting of two units of their immense mill, which had been idle for several years, but now since April has been handling 500 tons per day of the lead-zinc sulphides; the combination of the Clarinos, Los Remedios, and Reforma as the Hinds Consolidated Mining Co., with a good working capital; and the leasing of the famous Palmilla of Pedro Alvarado for 15 years to J. A. Coram and associates of Boston. At the San Francisco del Oro, where great bodies of sulphides, into Guanacevi of the large English company on the Restauradora, the Mines Finance Co. (J. B. Farish) on the Garibaldi mines, and the Mexico Mining & Smelting Co. of Boston on the Nuevo Australia, Soto, and Porvenir.

In Zacatecas, the most important events are the completion of the 500-ton lead smelting plant of the Mazapil Copper Co., at Saltillo, which will be a custom smelter as well, though not in the sense of a competitor to the Monterrey or San Luis Potosi plants; the acquisition of the concession of Walter C. Palmer by the R. A. Towne interests, and the completion of the survey for the railroad between the Mexican Central station of Gutierrez to the towns of Sombrerete and Chalchihuites, a road that has been greatly needed, and by which the Towne interests could have saved many thousands of dollars in working their Sombrerete mines had they built the line 15

On the Road to the Mines.

running about 11% lead and 23% zinc, have been opened up, preparations are being made for experimental treatment by the Sutton-Steele dry tables and the Mineral Separation Co.'s oil-flotation process. At the camp of Nalca, which has been so long an almost one-mine camp, the Lepanto and the Ramon Corona are rapidly increasing their production and crowding the Nalca for first place, which latter it is understood the Vogelsteins were seeking for P5,000,000.

In Durango we have seen during the year a successful turn in the operations of the Velardeña smelting plant of the American Smelter's Securities Co., leased to the A. S. & R. Co.; the practical rebuilding of the Maplmi smelter of the Peñoles Mining Co., and its active entry in the markets as a custom plant; the opening of an almost new camp at Topia, by the development work of the Macdonald brothers on La Perla lead mine, the erection by them of a concentrating plant, and the expected railroad connection with Culiacan; the proving up of the immense gold quartz deposits at Indé on the Guadalupe and the property of the Indé Gold Mining Co., the consolidation of the two under the name of the latter, and the completion of its 100-ton cyanide mill; and the entry years ago. Near the city of Zacatecas, the English company operating the El Bote mine has changed over from amalgamation to cyanide, an act that it is to be hoped may presage better milling, so that the coming year may see the resumption of many old properties and the successful use of cyanide as at Guanajuato.

In Guanajuato improvement and development continue unabated; the weekly payroll has reached the nice sum of P80,000; the Guanajuato Power & Electric Co. has taken up more water rights to give additional power to the camp; the Sirena of the Guanajuato Consolidated, the first of the modern companies, has opened up an immense body of P35 ore below the fifth level, which seems to be improving with depth; the Pinguico has also greatly added to its ore reserves; the Guanajuato Reduction & Mines Co. has increased from 80 to 210 stamps, and even for this mill it is estimated there are some 12 years' supply in the old dumps to say nothing of old fillings in the company's Valenciana, Cata, Mellado, and Rayas mines; and the San Cayetano has finally been purchased from the old English company by a New York company. Greatly to the credit of this old camp may it be said that scarcely a failure has been made of

any property there that has had anything like a sufficient working capital. But of greatest importance to the future of the camp are the cutting of the Porfirio Diaz tunnel, which precludes the possibility of recurrence of the devastating floods of 1903 and 1905; the long-needed entry of the Mexican Central Railroad into the city of Guanajuato, thus cutting off untold expenses and inconveniences; and the beginning of construction work on the Guanajuato Belt Railroad, which will bring almost all the mines and mills of the camp in direct connection with the Mexican Central Railroad.

Jalisco has seen the renewal of life and the remarkable success following the re-opening of the old mines in the Hostotipaquillo district, as well as in the development work on extensions of the old veins; the entry of strong American companies in the Mascota, Real El Alto, San Sebastian, and Los Reyes districts; the opening up of the copper properties around Autlan and Ayutla; the practical completion of the 250-ton cyanide plant of the Amparo Mining Co. near Etzatlan; and the hope of cheap power held out by the Electric Light & Power Co. of Guadalajara from its contemplated power line to the above mentioned camps of the State, excepting perhaps Ayutla and Autlan.

The mines of El Oro, in the State of Mexico, have taken on a new lease of life with the finding early in June of a new orebody at 1000 ft. on the San Rafael vein in the El Oro. The workings had been getting poorer in depth and the future of the district was being despaired of until this discovery was made, for, being a sulphide body, it seems to indicate persistence of ore in depth. The completion of the power plant of the Sultepec Electric Light & Power Co. has made possible the resumption of work at many of the properties at Temascaltepec and Zacualpam, where distance from the railroad and fuel had formerly made economical working an impossibility.

In Hidalgo, also, electricity and cyanide are going hand in hand. At Pachuca, the birthplace of the patio process, the old process has had to give way to the new in the form of cyanide. The first experimental work on a large scale was done by the United States Mining, etc., Co. at its Real del Monte mines, and work is being pushed on two 250-ton plants. Learning of the success of the cyanide treatment for local ores, the owners of the Hacienda de San Francisco, one of the oldest patio plants in Pachuca, after an idleness of about six years, early in the year of 1907 made the alterations necessary and opened up as the pioneer cyanide plant in the old historic camp of Pachuca, being soon followed by La Union, another of the old patio 'haciendas.'

Oaxaca has been fortunate in the successful maintenance of the little lead smelting plant of Hammer & Williams, at Magdalena, which has been recently reorganized as the Magdalena Smelting Co. of New York, with a capital of P5,000,000 and J. H. Williams as general manager. The Oaxaca Smelting & Refining Co. has not been so fortunate, meeting with financial difficulties before being able to blow in. It was forced into the hands of a receiver, but it is believed the coming year will see it on a solid basis.

The oilfields of San Luis Potosi have rapidly increased in importance, and an immense combination has been effected (by E. L. Doheney) of the principal fields of Tamaulipas, Vera Cruz, and San Luis Potosi with the holdings of the Mexican Petroleum Co. in the latter State.

The great bodies of zinc carbonate brought good times to Villaldama, Sabinas Hidalgo, and Vallecillos, in the State of Nuevo Leon during the first half of the year, but the decline in the price of this metal and the continued difficulties about the question of duties into the United States has caused a marked falling off in the shipments.

Coahuila has become almost synonymous with coal in the minds of the people of Mexico, by reason of the enormous beds of soft coal underlying great areas in this State; and the past year has seen several companies organized as competitors to the Mexican Coal & Coke Co. of Las Esperanzas, which so long held a practical monopoly on Mexican coals. Chief of the new companies is the Sabinas Coal Co. at Rosita and Agujita, whence the combined product is over 3000 tons per day, with a 1000-ton washer both at Rosita and Agujita. This company has been strengthened in the last few months by a combination with the Mexican Mining & Industrial Corporation, an English concern, which already had ground near-by and was producing close to 1000 tons per day. Another important move was the separation of the coal lands from the other holdings of the Monterrey Iron & Steel Co., and placing them in the hands of a sub-company, to be known as the Northern Coal Co., with a capital of P10,000,000, of which P1,000,000 is to go at once into exploration and development work. Several other million peso companies are operating in these Coahuila fields.

Throughout the year the greatest difficulty has been experienced throughout Mexico in obtaining cars for the movement of all classes of material, and this has been felt severely by the mining interests, for all the railroads report that 50% or over of their total freights have been ores or supplies to and from the mines and smelters. No wonder was it then that a cry went up over the whole Republic when the railroads proposed a new tariff that would have meant an increase in the rates anywhere from 50 to over 100%, dependent upon the grade of the ore and the length of haul. The result of vigorous objection was that the Government Commission made a material reduction in the proposed tariff, but has allowed a classification into those under P25 valuation, those between P25 and P50, and those over P50, with an increase over the existing rates on the three classes of 10, 20, and 30%, respectively; though it is not intended that these shall go into effect until after there has been some clearing in the general financial situation. The expected merger of the Mexican railroads under Federal control has likewise been delayed, because of the financial disturbances.

The scarcity of labor has become intensified all over Mexico, and in many localities where there were men they could not be induced to work. Many attempts were made to improve matters by the importation of Japanese, but generally it proved a poor experiment, for the Japs were far worse than the Mexicans, and they not only did not know how to work but they did not care to work. Up to the time of the financial troubles the growth of Mexican industries was phenomenal. Notwithstanding a great reduction in the stamp law and other taxes, the Federal revenue and surplus for the year has been far greater than ever before in the country's history; the banks have shown an ever increasing reserve, and the coinage of the country, now limited to that from the mint at Mexico City, or by contract in the United States, is being constantly augmented by many millions in both gold and silver. Mexico has been checked, of course, by the depression that has affected all, but its movement is onward and upward; it cannot now be held back; its railroads, its mines, its water-power, its agriculture are all undergoing progressive development.

THE four deepest mine shafts in the world are in the Lake Superior copper region within a mile of each other. These are the Red Jacket shaft of the Calumet & Hecla Co. and shafts No. 3, 4, and 5 of the Tamarack Co. The first is vertically 4920 ft. and the Tamarack No. 5 is a vertical shaft 5130 ft. deep.

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Editorial.

LONDON has felt the depression of 1907 acutely. According to *The Bankers Magazine*, the depreciation of stocks has been the worst in twenty years. In 387 active securities quoted on the London Stock Exchange there has been a depreciation of $1,710,000,000, on a nominal capital of $17,125,000,000; that is, the fall is equal to 9 per cent. In 17 leading American securities, bought and sold at London, the decline is measured by $775,000,000, or 32 per cent. These are impressive figures.

WITH THE ERECTION of the first steel column on the pediments that mark the foundation of the new Palace Hotel, there comes the promise that this famous caravansary will soon become a feature of life in San Francisco. The skeleton of the big structure will contain 6300 tons of steel, besides 1000 tons of grillage and bases. The hotel will be ready for business in about two years. Meanwhile, we are glad to chronicle the re-opening of the St. Francis Hotel, which survived the earthquake only to be gutted by the conflagration of April 18, 1906. The interior of the renovated hotel is so like its former self as to suggest, to those within the building, that the earthquake-fire was but an ugly nightmare. Mining engineers, who are necessarily nomads, will be glad to know that San Francisco now affords plenty of hotel accommodation and is once more the hospitable city of old renown.

SOON we shall have passed through the orgy of statistical misinformation that marks the beginning of every year. Scribes that must show increases of production in their county or their State, amateur statisticians that are forced to prove the advancing strides of industry in their own habitat, can take a rest and confess their sins of exaggeration. To the innocent reader of the reviews of progress in mining regions it might seem as if a veritable shower of gold or a flood of silver were about to overwhelm us; each county seems to be able to do as much as a whole State, and each State seems capable of producing enough metallic wealth for the whole Nation. The result is bewildering and most unconvincing. We doubt if any town, district, or State gains in reputation or general estimation from the corruscating Niagara of blatherumskite outpoured during the closing hours of the year. Exaggeration is futile, and it does not prevail.

BY THE TRANSFER of the control of *The Times* to C. Arthur Pearson, the leading daily paper of the world passes out of the hands of the Walter family, which has owned it for four generations. One would suppose that an event of such general interest and unusual significance would receive adequate notice, if

not intelligent comment, at the hands of our local contemporaries. The *Chronicle* gave the telegraphic news without comment, the *Call* failed to notice the fact at all, and as for the *Examiner*, since we never read that paper we cannot say what sort of stuff it printed on the subject. Undoubtedly *The Times* has lost in public estimation by its exploitation of a book trade during recent years and, even if it has not deteriorated, the number of rivals has been increased; nevertheless this great exemplar of serious journalism holds a unique position and still exerts a worldwide influence. Mr. Pearson is a clever man and has modern notions of what a newspaper should be; it will be interesting to see if he can rise to the occasion.

WE TAKE PLEASURE in publishing the article discussing the leasing of Federal coal lands. The author, Mr. H. Foster Bain, is director of the Geological Survey of Illinois, and apart from his knowledge of local conditions, he has been trained at Johns Hopkins University and by service with the United States Geological Survey, two preparations for observing carefully and writing clearly. The movement to introduce the leasing system is a direct result of the abuse of power on the part of the existing coal companies and the demonstration of an oppressive monopoly in the anthracite trade. The truly American idea of fostering individual initiative and affording free play to the adventurous spirit of the man who develops natural resources has worked out not wholly for good, in so far as it has given free rein to the greed of capitalists and the unscrupulous methods of corporations having no recognition of any obligations to the community. By the excesses of such agencies we have become receptive to government paternalism, and the reader will find that Mr. Bain has stated the case fairly and squarely.

THE ARTICLE on Nagybanya, an old goldfield in Hungary, will prove interesting. It is written by Mr. Edward Skewes, at one time in practice at Cripple Creek and then general manager of the Great Boulder Main Reef mine in Western Australia. The Hungarian gold mines described by him produced 1,554,828 kronen or $310,000 worth of gold in 1906, and the official report estimates the value of the land, offices, and buildings that cannot be removed at 13,382,498 kronen or about $2,678,000. From a mining standpoint this region in eastern Europe is one of the great has-beens of history. During the time of Trajan, who conquered Dacia and made it a province of Rome, in the first century, these goldfields were the most important in the Roman empire. As a part of Transylvania they continued to be productive and afforded matter for early geological studies. In the dumps of the old mines Roman coins have been found, the gold so pure as to be soft. It is likely that the silver-gold bullion of the mines was refined by the use of salt, with the formation of a silver chloride that is readily amalgamated. An attempt has been made to introduce modern machinery into Transylvania with a view to exploiting the low-grade ores remaining in the old mines, but the results have proved that the cheap labor of the past could give better economic resultts han the mechanical devices of today.

A Tribute to Civilization.

RETROSPECTS of 1907, and of the financial disorganization that came so suddenly last October, have been general at the beginning of the new year. The sober thoughtfulness induced by a personal experience of the late unpleasantness has led most of us to read the opinions and forecasts of individual financiers as published in the daily press of the larger cities. In the midst of the bewilderment that followed in the wake of the panic these authoritative statements are decidedly reassuring, for most of the big men talk hopefully; they emphasize the industrial power of America, the capacity for further progress, the courage and vigor of the people, and the wealth of natural resources. Undoubtedly this chastened optimism is well founded; the wealth of all classes, by reason of a series of fortunate years, is such as to enable them to meet a business reaction successfully; the number of actual failures has been small, the crops now being marketed have been bountiful and are being sold at unusually high prices; speculative activity has been sobered, not killed; if 85,000,000 people will economize even but a little they can create an enormous fund of capital in a short time. After all, the primary trouble of 1907 was the exhaustion of capital; this was felt all over the world, the increasing production of gold being futile to correct it, for the business of the nations had outrun the resources available. Most students of finance agree that within the last few years the absorption of capital into various forms of fixed investment has been the greatest ever known and until this capital becomes reproductive it ceases to be serviceable for new enterprises. Moreover, in this country the extravagant diversion of capital into Wall Street speculations had reached a pitch never before attained, causing a vast amount of money to be tied up in unproductive gambling. On the top of this it was proved that the corporate management of some of the largest industrial and financial enterprises was rotten and that one or two leaders had acquired a destructive power intensely disquieting to the investing public. Until such men as Harriman, Ryan, Gates, Morse, and Heinze can be eliminated from the management of industrial enterprises of national importance there is no safety for shareholders, who but supply the facilities whereby these gamesters play their astounding games of chance and plunder.

No more striking testimony to the advance of industrial civilization can be offered than the small number of insolvencies chronicled in the United States during the recent panic and throughout the year. In 1907 there were 11,669 failures, with liabilities aggregating $195,479,214; besides 126 banks that failed for a total of $123,736,377 as against 10,682 commercial failures for $119,201,515 and 58 banks for $18,805,380, in 1906. The increase of insolvencies is extraordinarily small when we consider the volume of business transacted and the violence of the panic that convulsed the commercial

world in October and November. Of course, many weak concerns were bolstered up and many individuals were kept from bankruptcy by making a heavy sacrifice of their resources, and the result to many of them may have come perilously near to utter destruction, but it stopped short of absolute failure, and that meant much, not to them only but to the general restoration of credit in the community. Nowadays, the transfer of money by cablegram, the flashing of quotations on stocks to every corner of the globe, and the facilities afforded by a marvellously developed system of posts and telegraphs, have widened the range of business transactions and spread the base of credit to such an extent that panics are no longer local. If one community is in trouble, another gets a fit of the nerves; no city and no country is independent financially of the doings of its neighbors, when even distance ceases to be a barrier to neighborly responsibility. Viewed in this light it is astonishing that the sudden and violent collapse to credit in the last quarter of 1907 did not precipitate worse results. Despite revelations of plunder and exposures of corruption, men trust each other as they never did in any preceding period of history. Civilization is not a failure and the Caucasian is not played out.

Assisting Graduates.

BEWICK, MOREING & CO. deserve the gratitude of graduates from the mining schools, for this company has established a system by which it gives young fellows a chance to learn their profession. It is a sort of apprenticeship, modified to modern conditions. For several years now it has been the custom of this engineering firm to take a stipulated number of men from the Royal School of Mines, London, on the recommendation of the council of that technical college, and grant them facilities for taking a two years' course in mining and milling at the mines managed by the company. These students are expected to do the regular work alongside of the regular employees and they receive the standard wages. For instance, if a graduate is received at one of the West Australian mines, he may spend one month with the sampling crew or the timber gang, drawing pay at $2.75 per shift; in the next month he may be assisting the surveyor at $20 per week, and in the month following he may be in the cyanide plant receiving about $3 per shift. At the end of two years of varied labor, such a young man has been both tested and developed; he is eligible for a place on the permanent staff and, as a matter of fact, a number of these graduates have obtained responsible posts at the mines. Arrangements of a similar character have been made with the universities at Sydney, Melbourne, and Adelaide, the capitals of three Australian States. It is not necessary to emphasize the advantage of this method of promoting engineering education. Nothing could be more practical or more kind. The young aspirant for a place in the profession is able to get a sound groundwork of practical knowledge, while paying his way, and even saving some money. We advise those that succeed in saving money in the days of their apprenticeship, to spend it in travel, which is an excellent supplement to local experience. In the meanwhile, this reference to the subject is meant not so much for the information of mining graduates as it is intended to serve as a suggestion to the successful managers of mines and smelters, pointing out to them how they can help the young fellows and do honor to themselves. It is a more practical form of assistance than the gift of libraries or the donation of medals.

Smoke Suits.

THE true nature of the larger part of the agitation against the smelters in Utah and Montana is now made manifest. In the Salt Lake valley and in that of Deer Lodge, the farmers have complained that the reduction works have emitted fumes highly destructive to their cattle and crops. They have harrassed the smelting companies with lawsuits and injunctions, protesting loudly that they were entitled to the pursuit of happiness and the cultivation of their farms, even if the mines were closed down for lack of a local ore market. The farmers have rights and they are entitled to assert them, but we have always insisted that much of the organized agitation against the smelters was maintained in the hope of blackmail, that it was anti-social in so far as it disregarded the wider interests of the community at large, and that it would end in outlawing an industry just as much entitled to consideration as that of the man who cultivates the soil or breeds cattle. On the other hand, it must be allowed that the smelter people have not always shown a proper regard for the welfare of the community, and they have exhibited poor judgment in erecting smelters on sites likely to provoke a nuisance and invite litigation. However, the fact now is that the farmers in the Salt Lake valley are willing to let the Utah Consolidated Copper Company proceed with its smelting operations if but the sum of $125,000 is paid to them. This blackmail was originally $300,000; by bluffing and counter-bluffing it has been reduced considerably. The smelting company is willing to pay $100,000, but not a cent more—so it is stated. The outcome will be awaited with interest, but the main point is that the farmers are evidently public-spirited for revenue only, there is no principle at stake save that of highway robbery, no purpose save sublimated selfishness. In Montana also, there is a rumor that the Amalgamated Copper Company, controlling the Washoe smelter, is to ward off the legal assaults of the embattled farmers of the Deer Lodge valley by making a settlement, which contemplates nothing more or less than the purchase of all the farms at a big price, after the courts have passed judgment on the small amount of injury actually done to the land or the cattle on it. We shall be surprised if these developments in Utah and Montana do not cause a revulsion of feeling and lead to a refusal of support in future to proceedings from which all disguise has been stripped, showing them to be simply the blackmailing of a metallurgical industry essential to the development of our mineral resources.

Personal.

LESTER W. STRAUSS is still in Peru.

ALGERNON DEL MAR is here for a few days.

THOS. J. BARBOUR is now a resident at New York.

DOUGLAS WATERMAN goes to Chile on January 17.

H. C. HOOVER has returned to London from Burma.

COLIN TIMMONS is residing at Taxco, in Guerrero, Mexico.

J. H. MEANS has been studying the sulphur deposits of Sicily.

CHARLES A. CHASE has an office in the Equitable Bdg., Denver.

GEORGE J. BANCROFT is now editor of *Mining Science* at Denver.

E. J. CARLYLE is on his way from New York to Perm, in Russia.

W. H. LANDERS has moved to 160 Sansome St., San Francisco.

F. W. SMITH has been examining mines near Zacatecas, in Mexico.

PERCY A. BABB has opened an office at Calle de Gante 12, Mexico City.

SCOTT TURNER has returned to San Francisco from Manhattan, Nevada.

ARTHUR R. TOWNSEND has his office now at 52 Broadway, New York.

ERNEST A. HAGGOTT has an office now at 500 Hellman Bdg., Los Angeles.

THOS. G. DAVEY has opened an office at 210 Finsbury Pavement House, London.

WAGER BRADFORD, on his return from South Africa, is at Westernville, New York.

W. L. COBB has opened an office in the Merchants Exchange Bdg., San Francisco.

W. F. COPELAND, manager for the Cariboo Con. Mining Co., B. C., is here for the winter.

C. W. PURINGTON is now at London, but he expects to return to Eastern Siberia shortly.

OSCAR B. PERRY has returned to New York after spending the holidays in San Francisco.

D'ARCY WEATHERBE has resigned as manager for the Capillitas Copper Co. in Argentine.

PHILIP R. BRADLEY has left San Francisco on his return to the Peters mine, in British Guina.

ELWYN W. STEBBINS, formerly in the Chronicle Bdg., is now in the Mills Bdg., San Francisco.

WALTER NEAL is superintendent of the cyanide annex of the Dos Estrellas Co., at El Oro, Mexico.

ATWATER, LINTON & ATWATER have an office now at 52 Broadway, New York, and at Magdalena, in Sonora, Mexico.

E. P. JONES, lately mechanical engineer with Bewick, Moreing & Co. in Australia, is now chief engineer to the Risdon Iron Works, in San Francisco.

DONALD B. GILLIES, who was recently made president of the San Toy Mining Co., is spending a few weeks at the company's mines in Santa Eulalia district, near Chihuahua, Mexico.

Mineral Production of British Columbia in 1907.

Gold, placer	35,000 oz. at $20.00	$700,000
Gold, lode	199,770 oz. at 20.67	4,129,246
Total gold	234,770 oz.	$4,829,246
Silver	2,940,190 oz. at 63c	1,852,320
Copper	38,392,264 lb. at 20c	7,678,453
Lead	48,309,660 lb. at 4.8c	2,318,864
Total metalliferous		$16,678,883
Coal	1,856,600 tons at $3.50	86,498,100
Coke	227,000 tons at 6.00	1,362,000
Total coal and coke		$7 860,100
Miscellaneous (building stone, cement, lime, bricks, tiles, etc.)		$1,200,000
Total non-metalliferous		$ 9,060,100
Estimated total mineral production in 1907		$25,738,983

Latest Market Reports.

LOCAL METAL PRICES—Jan. 9.

Antimony	12@16c	Quicksilver (flask)	$45.5
Casting Copper	17½@18½c	Spelter	6@ 6.75c
Pig Lead	3.85@ 4.80c	Tin	33@34½c

ANGLO-AMERICAN SHARES.

Cabled from London.

	Jan. 2. £. s. d.	Jan. 9. £. s. d.
Camp Bird	0 14 0	0 13 3
El Oro	1 1 3	1 2 6
Esperanza	1 9 0	1 7 6
Dolores	1 0 0	0 17 6
Oroville Dredging	0 13 0	0 13 0
Stratton's Independence	0 3 3	0 3 3
Tomboy	1 7 6 ex div.	1 7 6

(By courtesy of W. P. Bonbright & Co., 24 Broad St., New York.)

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date	Electrolytic Copper	Lead	Spelter	Silver
Jan. 3	13⅜	3.58	4.30	55⅛
" 4	13⅜	3.63	4.33	55⅛
" 5	Sunday.	No market.		
" 6	13⅜	3.68	4.38	55⅞
" 7	13¾	3.68	4.38	58⅜
" 8	13¾	3.63	4.38	57⅛
" 9	13¼	3.63	4.38	56

MINING STOCK QUOTATIONS—NEW YORK.

	Closing Prices. Jan. 2.	Jan. 9.
Alaska Mexican	.....	.....
Alaska Treadwell	28	.....
Bingham Central	¼	¼
Boston Copper	10¼	13½
Cumberland Ely	6⅜	7⅜
El Rayo	1¾	1¾
Guanajuato Con	2⅛	2½
Giroux Con	2½	2⅝
Nevada Con	8⅝	9⅛
Nipissing	6¼	7⅛
Tennessee Copper	26	26
Tonopah Ex	1.50	1.32
Tonopah-Belmont	0.69	0.88
Tonopah	4	4.50
United Alaska	3⅜	.....
United Copper	7⅛	7½
Utah Copper	20¾	22⅝

(By courtesy of Hayden, Stone & Co., 25 Broad St., New York.)

SOUTHERN NEVADA STOCKS.

San Francisco, Jan. 9.

Atlanta	$ 33	Laguna	80
Belmont	70	Manhattan Con	23
Columbia Mtn	16	Midway	57
Combination Fraction	73	Mizpah Extension	10
Daisy	93	Mohawk	12 00
Fairview Eagle	35	Montana Tonopah	1.77½
Florence	4.02½	Nevada Hills	2.70
Gold Bar (Bullfrog)	37	Red Top	2.00
Goldfield Con	95	Sandstorm	23
Goldfield of Nevada	5.00	Silver Pick	30
Gold Kewanas	37	St. Ives	46
Great Bend	19	Tonopah Extension	1.35
Jim Butler	40	Tonopah of Nevada	4.85
Jumbo	.....	Tramp Con	18
Jumbo Extension	60	West End	33

(By courtesy of W. C. Ralston, 368 Bush St.)

COPPER SHARES—BOSTON.

	Closing prices. Jan. 9.		Closing prices. Jan. 9.
Adventure	2½	Michigan	10½
Ahmeek	60	Mohawk	51¼
Allouez	30	Nevada Con	9⅛
Amalgamated	50⅝	North Butte	45⅞
Arcadian	4¼	Old Dominion	30⅜
Atlantic	9½	Osceola	87
Balaklala	2⅜	Parrot	10½
Bingham Con	4	Phœnix	50
Boston Con	13½	Quincy	84½
Butte Coalition	15⅞	Raven	85
Calumet & Arizona	105½	Rhode Island	3¼
Calumet & Hecla	605	Santa Fe	2⅜
Centennial	26¼	Shannon	10¾
Con. Mercur	27	Superior & Pittsburg	11¼
Copper Range	59½	Tamarack	67
Daly-West	7⅞	Trinity	16¼
Franklin	8¾	United Copper com	7¾
Granby	82	Utah Copper	22⅜
Greene-Cananea, ctf	7⅛	Victoria	4⅞
Isle Royale	19⅛	Winona	5⅛
Mass	3⅞	Wolverine	122

General Mining News.

ALASKA.

A body of sulphide ore which is said to carry good values in copper and gold has been found by D. Nicol in developing his mining location at Karta bay, in the Ketchikan district. This property was bonded once, but was exploited for speculative purposes, and finally reverted to the original owner, who is vigorously prosecuting its development.—— At the Lon-de-Van galena mine, near George inlet, an adit has been commenced; it is to be 800 ft. long and cut the lode at a depth of 575 ft.—— It is reported that at the Niblack mine there was found recently a body of the best ore known in the mine.——At the Held-Bach mine, in the Juneau district, a cross-cut on Dec. 18 was 30 ft. in the lode; the ore exposed is of better quality than that found on the surface. ——About 1200 men were employed at the Treadwell mines in December; more miners were arriving on every boat.—— In the Council district of Seward Peninsula, the Homestake Mining Co. has discontinued prospecting with a drill and has begun to sink a shaft.

ARIZONA.

COCHISE COUNTY.

The Savage Gold & Copper Co. intends to begin shipping ore to the Copper Queen smelter at Douglas as soon as the necessary arrangements can be made. The ore carries copper and silver; it is largely silica, which can be used at the smelter as converter lining. A new road is being built to facilitate the hauling of machinery to the mine and ore to the depot.—— Development at the Bauer group of claims, six miles east of Bisbee, is said to be resulting satisfactorily; the deepest shaft is claimed to be entirely in good ore.—— The strike in Bisbee was declared off by the Western Federation of Miners at a special meeting held on Dec. 26.—— Duffner Bros. have found some ore at the Nippers mine; it carries light value in copper and contains much manganese, iron, and calcite.—— Clarence May is sacking ore at his mine in Round valley; the value is chiefly in silver, but the ore carries from 2 to 24% copper. From six carloads of ore that have been shipped the net returns varied from $5.50 to $35.50 per ton.—— At the Bisbee-Sonora Development Co.'s mine, in the Chiricahua range, the entire breast of the adit is ore; it is expected to begin shipments soon.——The Mountain View Development Co. is driving a cross-cut from a point 160 ft. down the shaft to get under a body of ore that was found 100 ft. higher; 10 tons of it yielded $106 per ton.—— A small force of men is working on the property of the Manhattan Development Co.—— At the Scanlon mine a fine body of ore was recently found.

GILA COUNTY.

An adit has been begun at the Yellow Metal mine in Lost gulch, to cut at a depth of 100 ft. a vein which recently attracted attention on account of the discovery in its outcrop of a pay-streak 1½ in. wide which assayed $7000 gold per ton. E. F. Kellner is the owner.——Ore running from $6000 to $10,000 gold per ton is reported to have been found in an old shaft on the Emmiline claim of the Radium Mines Co. This claim has yielded much silver ore in the past.——The Old Dominion company is operating four furnaces, two of which are running entirely on slag from the dump. This slag contains 2½% copper. The company is daily hoisting from its mines 350 tons of concentrating ore and 250 tons of smelting ore. The output from its smelter is over 2,000,000 lb. copper per month; 70% of this is derived from its own ores.——The three-compartment working shaft of the Arizona Commercial mine is now down 100 ft.——Excellent progress in development is reported from the Fumarole mine in the Gila mountains.

GRAHAM COUNTY.

A carload of high-grade manganese-copper ore has been shipped from the Gold Belt mine to the Shannon smelter. The company is also making up a carload of its high-grade gold ore.——The Shannon Copper Co. is preparing for the enlargement of its two old furnaces so that it may have a smelting capacity of 3,000,000 lb. copper per month.—— The Arizona Copper Co. has completed one of the best smelter runs in its history; the product for December was 3,000,000 lb. of bessemer copper.——The mines of the New England & Clifton Copper Co. have been closed, as the company has been under too heavy expense to continue operations at present metal prices.——At the Gibson mine between 40 and 50 men are working; about 250 tons of sulphide ore are shipped monthly from this mine to the Old Dominion smelter.

MARICOPA COUNTY.

Construction work on the new mill at the Monica mine is progressing satisfactorily. A wagon-road has been finished to the mill and men are now grading for the cyanide plant. Operations in the mine have been suspended until the mill is finished. The Monica lode is opened by an adit at a depth of 1000 ft. There is enough ore on the dump to keep the mill in operation for several months.——On the property of the Merchants Mining Co. there is said to be developed at the depth of 165 ft. a lode four feet wide, of which 18 in. is ore that carries 67% lead, 40 oz. silver, and

Map of Arizona.

$25 gold per ton. At the depth of 300 ft. the lode is 26 ft. wide, but the ore is low-grade.

MOHAVE COUNTY.

A 40-hp. hoist has arrived at Yucca for the McCracken mine. The Palo Verde Mining Co. is now cleaning out the old drifts, re-timbering openings, and getting things in shape for extensive work. Accomodations have been prepared for a large force of miners; the camp promises to become one of the most important in the county within a year. J. L. Witney is manager.——The report has reached Kingman that J. P. Richardson has made a wonderful strike of gold ore in the Union Pass district.——J. D. Spargo will keep a force of men at work during the winter at the Brown mine at Stockton Hill which he has leased from the C O D Mines Co.——The Gold Road mine has been closed pending the settlement of difficulties between the French and American shareholders.——It is reported that an important discovery of ore has been made at the German-American mine near Vivian. The property has a 10-stamp mill but it has not been operated from lack of water; it is now expected that water for the mill will be secured from the Victor Gold Mining Co.'s pumping plant.—— The Chloride Gold Mining Co. has leased its Samoan mines to Roy Wright. Work is progressing and a shipment of good ore is now ready.——At the Gladstone mine driving the

adit has exposed heavy lead ore carrying value in gold and silver.——A large amount of machinery for the Tom Reed Mining Co. is passing through Kingman.—— The mill treating ore from the Idaho mine is running smoothly; by means of magnetic separators a clean zinc product is being made. A large body of ore is exposed by drifts from the bottom of the Idaho shaft.

PIMA COUNTY.

The Growler Copper Co. is installing a new hoist and engine at its mine, 65 miles south of Gila Bend. The main shaft is 250 ft. deep, and there are 175 ft. of drifts. Development is to be pushed, and the company expects to be shipping ore in a short time.—— Ore carrying gold, silver, lead, and copper is being shipped to the El Paso smelter from the mines of the Sultan Gold Mining Co., which are under lease to C. S. McHenry and A. Hoover.—— The Mansfield company is sinking a shaft to the 550-ft. level in the Sweet mine; it is mining ore on the 250-ft. level. Ore shipments are frequently made from the Black Cat mine to the El Paso smelter.—— The Tucson Consolidated Copper Co. is working at the Old Pueblo mine with a reduced force of men; the shaft, which is now down 175 ft., is to be continued to a depth of 500 feet.

YAVAPAI COUNTY.

The mill is practically completed at the Dunkirk mine in the Slate creek section; the ore-shoots exposed in the upper and lower adits are improving under continued development. A. H. Mitchell is superintendent.—— The shaft at the Verde Grande mine in the Jerome district has penetrated slate carrying sulphides; this shaft is 419 ft. deep.—— The Haynes Copper Co. being unable to handle the water flow with a whim, has shut down, awaiting the arrival of machinery.—— The Arkansas-Arizona mine is temporarily closed on account of water.—— At the Boston-Jerome mine the shaft is down 128 ft., exposing good ore.——The road to the Mescal mine is nearly completed; it is expected that development of the mine will begin soon.——The Arizona Placer Mining Co. is preparing to test its ground in the valley of the Hassayampa river to determine the advisability of erecting a large dredge.——At the Venezia mine, Frank Olin, a lessee, has found gold ore of a width of 4 ft. in a shaft at a depth of 82 ft.; a whim is being erected to enable sinking to a much greater depth.——E. H. Eplustill, Henry Price, and Willis Spence have 2 ft. of high-grade concentrating ore at the distance of 100 ft. from the portal of the Portland mine, near Palace station.——At the Buster Brown mine, Leroy Spence and Burt Evans are sinking a shaft on a lode which at a depth of 40 ft. has 2 ft. of good ore.——At the Jaunita mine a small force of men is driving an adit; it opens an orebody 8 ft. wide which is said to carry $22 per ton.——O. I. Tawney made a small shipment of ore from the Peck mine; it carried 750 oz. silver per ton.——The Leontina Consolidated Mining Co. has purchased the Revenue group of claims in the Big Bug district. Four of the locations have been made on a large porphyry dike which has been explored along the foot-wall by a shaft 114 ft. deep; in the bottom of this is ore carrying 4.9% copper and a sufficient quantity of gold to make the total value $45 per ton. The new owners intend to sink the shaft to the depth of 600 ft. and explore the dike by several hundred feet of cross-cuts and drifts.——At the First Home mine, in the Big Bug district, 8 tons of ore were taken from the 240-ft. level; this ore carried 50% lead, 20 oz. silver, and $20 gold per ton.——The people of Wickenburg are excited over the prospect of the Vulture mine soon resuming operations. ——A 53-lb. bar of gold from the Octave mine was on exhibition in Prescott on Christmas. The company that owns the Octave mine also owns the Mudhole mine at Walker, on which it is planning to resume work in a short time.—— W. M. Nellis is preparing to install a hoist and pump at his French Lily mine in Crazy basin.——The Haynes Copper Co. has purchased a double-drum hoist and an air-compressor powerful enough to run 12 drills.——S. Morrison and son have found some good ore in the Windsor mine in the McCabe district; it is from one inch to a foot in width and carries from $20 to $80 gold per ton.

YUMA COUNTY.

A carload of very rich ore has been shipped from the North Star mine; it is claimed that practically every piece of it carried gold visible to the unaided eye. Much of it was stolen. The value is estimated at $6000 to $7000 per ton. ——Plans are being made for the construction of a 50-ton smelter near Parker on the Colorado river.

CALIFORNIA.

CALAVERAS COUNTY.

Associated with the quartz vein in the Mammoth mine there has been found a streak 3 to 4 in. wide of red clay that is highly impregnated with gold, an assay giving it a value of $300 per ton.——The Stockton Ridge Consolidated Gravel Mining Co. is driving an adit to reach an old river channel; this adit is now over 1400 ft. long and it is expected to reach the gravel within another 400 ft. Stephen Hughes is superintendent.——Tom and Hugh McSorley and Edmund Stocker are working a drift mine near the old Boston mine; recently they secured 7 oz. of gold from two panfuls of gravel.

ELDORADO COUNTY.

A test run on 100 tons of ore from the Vivian mine is said to have given a satisfactory result.——A. Goldsworthy and Paul Ricci are developing a promising lode at the Oakland mine.——Mrs. L. E. Pease has abandoned work at the Garibaldi mine near Greenwood, but has a crew of men at work at the Geo. Bower mine.——At the Marshall mine in the Mount Pleasant district, a pipe-line is being laid preparatory to installing power-drills in the mine; the power will come from the air-compressor at the Mount Hope mine.

INYO COUNTY.

The new mill at the Casa Diablo mine is practically completed; F. J. Girard of Berkeley, Cal., has been engaged to take charge of the cyanide plant. A large body of good ore is said to be exposed in the Dry Bone drift.—At the Red Rose claims, near Bishop, active operations for development have begun. Very rich specimens have been secured from the outcrop of the lode; some on exhibition in Bishop are estimated to contain $50 per lb.——Zinc ore has been found by H. M. Gibson and P. W. Forbes in developing a silver-lead lode in Black canyon; its quantity has not been determined but it is wider than the adit.——Near Chrysopolis a number of locations have been made on presumed rich placer ground.——A big strike of ore is reported from the old Cerro Gordo mine near Keeler. It was found in sinking from the 850 to the 900-ft. level. The old smelting plant is being rebuilt.

NEVADA COUNTY.

(Special Correspondence).—Sinking is going on at the Central mine and considerable development work is being done below the 4000-ft. level.——A large force of men is steadily employed in development work at the Empire mine; a large tonnage of high-grade ore is being handled, and the mill is running constantly.——Promising ore is being developed in the Niagara mine; several men are employed, and much development work is being carried on. ——Extensive development work is going on at the Union Hill mine, and good ore has been encountered.——At the Kenosha a small force is developing a promising shoot of ore. The main orebody continues to show well with increased depth.——Active work has commenced at the Nevada hydraulic mine at Red Dog. The restraining dam is fulfilling expectations admirably, and the management expects to have a successful season.——The Junction mine has been closed. It is expected that active operations will be resumed in the spring. The management contemplates the construction of a tram-line before resuming work. The closing of the property is attributed to the financial stringency.——A ledge running from five to seven feet wide is being developed in the Barton mine. The ore carries from 50c. to $2.50 per ton free gold. The sulphurets carry good values. The advent of winter has forced the suspension of construction work on the new 30-stamp mill. This will be completed in the spring.——The strike recently made in the Champion mine continues to show up well; good ore is coming from the Home shaft.——High-graders are causing the management of the Plumbago mine con-

siderable trouble. An arrest was recently made, but no evidence could be secured to hold the suspect.

Grass Valley, Dec. 30.

E. D. Dean is sinking an incline to develop the Royal gravel mine at Selby Flat.——The Maryland mill has finished crushing 150 tons of ore from the Golden Gate mine; the lessees of this mine have a year to operate yet and are retimbering the old shaft and sinking it deeper. W. P. Martin is superintendent.——The adit at the Snow Point mine is being driven ahead; three men will be employed until spring.——D. Stewart and J. Waarden are driving an adit to open the back channel in the Loosenes gravel claim near Gott's ranch.——L. B. Clark and Henry Goering are opening up a placer mine near Round Mountain and the gravel they are washing is said to be giving good results.——Ten stamps have been added to the mill at the Yuba mine; 20 stamps are now dropping regularly on good ore, part of which is brought on the rebuilt tramway from the Mayflower mine. About 60 men are employed at the Yuba and Mayflower mines; Charles A. Marriner is manager.——Seventeen tons of ore taken at random from the Norambagua mine have been crushed at the Southern mill; the yield was $29.75 per ton. Nine men are employed at the mine in driving north toward a presumed large ore-body.——Preparations are being made for reopening the Normandie mine, owned by Frank Dulmaine. There are two known lodes, on one of which a 40-ft. shaft has been sunk. The property has been bonded to several young men from Reno, Nev., each of whom has taken a course in mining engineering.——It is reported that on December 26 Deer Creek carried away the ground-sluicing plants from several placer mines near the Newtown bridge.——The new 10-stamp mill at the Ancho mine near Graniteville is in operation; some good ore is being taken out of the mine.

PLACER COUNTY.

The dredge at the Cash Rock property has been launched; it is 84 ft. long and 44 ft. wide. The machinery is being put in place; 20 men are working on it.——Lukens & Sons have installed a steam-hoist at their mine at Hoggs Diggings and have taken out some good ore.——At the Herman mine 25 men will be kept at work during the winter.——A. Moer is driving a second adit at the Vineyard mine near the Wisconsin Hill-Yankee Jim toll-road.——The retimbering of the Grey Eagle tunnel is in progress.——A number of men are opening up the Polar Star mine.——At the McGeachen mine 20 men are taking out gravel; the new hoisting plant at the Juniper shaft is finished.——Four men are working at the Gleeson mine; the adit is about 400 ft. in good paying gravel.——At the Hidden Treasure mine 25 men are at work; a drift is being extended toward the Mountain Gate channel which it is expected to reach within 300 ft.——Henry McAuley has a number of men working in the Drummond mine; a hoisting plant is to be put up and a shaft sunk on the lode.

PLUMAS COUNTY.

The Plumas-Mohawk mine was closed some time ago, as no preparations had been made to run during the winter.——Four men are developing the property on Clearmont Mtn. that was recently purchased by W. E. Oddie. An arastra has been erected for the purpose of prospecting the ore. The vein is said to carry $10 to $25 gold per ton, as determined by mill-test.——O. A. Wheelock has taken a lease on the Taylor Plumas mine at Crescent Mills and intends soon to begin development work.——A. M. Hansen is opening up a placer mine about four miles east of the Jo Gill ranch.

SHASTA COUNTY.

At the Midas mine, at Harrison Gulch, about 70 men are employed. The 20-stamp mill continues in operation except when heavy snowfalls interfere with it. The ore developed is expected to keep the mill running for six or seven months. L. A. McIntosh is manager.——Senator F. W. Leavitt of Oakland has purchased a quarter interest in a group of claims north of the Mammoth mine near Kennett; development of the property is to be begun soon.——The completion of the Mammoth Copper Co.'s railroad bridge at Quartz enables the resumption of ore shipments from Old Diggings and Quartz Hill to the smelter at Kennett.——A 5-stamp mill has been built in Grizzly gulch by John Martin and son, to treat ore from the Trucott mine, six miles from Whiskeytown; there is said to be enough ore developed to keep the mill running for years.——The remodeling of the Bully Hill smelter is practically completed and the plant will resume operations as soon as the Sacramento Valley & Eastern railway has been finished to it. The smelter has been rebuilt on a larger and improved pattern, and over $100,000 has been expended on this work.

SIERRA COUNTY.

An upraise is being made in the South Fork adit in the hope of reaching an old channel deposit.——At the Keystone mine near Sierra City six men are stoping ore; the mill will resume operations as soon as sufficient water is available.——The Sovereign mine has been closed for the winter.——At the Hayes mine a small crew of men is working under the direction of Frank Summersville.

SISKIYOU COUNTY.

The Morrison & Carlock mine in Quartz valley and the Eastlick quartz mine near Greenview have closed down.

Map of California.

——The company operating on Sugar creek has been unable to get coin with which to pay the men, but it is believed that it will continue to operate.——The Milne Bros. are working their hydraulic mine at Johnson's Bar.——George Magoffey & Co. are rigging up their hydraulic mine on Mill creek near its junction with Scott river.——The owners of the Yellow Butte mine are preparing for a shipment of ore to the Mammoth smelter at Kennett.——An electric power plant has just been completed by the California Consolidated Mining Co. at Sawyer's Bar. The big flume, ditch, and water-right of the Salmon River Hydraulic Co. were purchased. Power will be supplied to the Ball group of mines and it is intended that next summer the line will be extended to the King Solomon mine.

TRINITY COUNTY.

The Bonanza King mine is in the hands of a keeper following the recent attachment of the property for wages due the 49 miners who worked in it.——The preliminary survey has been completed for the State highway that is to connect the central part of Trinity county with the road system of Humboldt county. When built this road will be of great benefit to the mining interests of the northwestern portion of the county.——A full force of men is working at

the La Grange hydraulic mine.——At the Globe mine an adit is being driven to connect with the Chloride mine, which is on the opposite side of the mountain.

TUOLUMNE COUNTY.

The Longfellow mine at Big Oak Flat has closed down; the employees are proposing to file liens against the property for unpaid wages.——The Montezuma Tunnel Mining Co. has leased its gravel mines to J. Hagman, who will continue driving the adit and inaugurate operations on Turner flat.——Thirty stamps are dropping in the Harvard mill; when new concentrators have been installed, 10 more stamps will crush ore.——The Eagle-Shawmut mine is in operation on a 9½-hr. workday; a force of 200 men is employed.

NEVADA.

ESMERALDA COUNTY.

Governor Sparks has called an extra session of the Nevada Legislature to convene on Jan. 14, to pass new laws for the policing of the State. Two full companies of soldiers have been ordered to remain in camp at Goldfield until after the Legislature adjourns. The remainder of the troops left on Jan. 3 for their various stations in California. Pickets and guards have remained on duty at the mines but there has been no trouble between them. On Dec. 27 a complaint was filed before the United States District Court at Carson City, by Attorney W. H. Bryant, on behalf of the Goldfield Consolidated Mines Co., praying for a writ restraining the Western Federation of Miners from interfering with the operations of the mines, also asking that the Federation be dissolved, as the organization is classed as a conspiracy. Judge Farrington set Jan. 3 for the hearing on the petition for a temporary injunction. Considerable progress has been made by a movement to form a new union entirely separate from the Western Federation of Miners and based upon the old Virginia City Union. Many of the miners are becoming convinced that the Goldfield Mine Operators' Association intends to remain firm in its determination never to employ members of the Federation, and they are beginning to consider any plan whereby they can go to work as union men and still meet the demands of the operators. Indeed, numbers of them are breaking away from the Federation and are going to work under the card system and under the new scale of wages adopted by the mine owners. On Jan. 4, the Combination Fraction mine, after an idleness of five weeks, resumed with three shifts, many of the men being former Federation men. On the same day, the Mohawk proper resumed work with former Federation men and new men from California and Utah. The two Becker leases at the Atlanta mine began work with new men brought into camp by the manager. The Von Polenz lease at the Florence mine also started up with a full complement of men.——C. W. Merrill, of Lead, S. D., has been in Goldfield for the purpose of looking after the erection of the 500-ton mill of the Goldfield Consolidated company on the west slope of Columbia Mtn., at an estimated cost of $700,000.——The management of the Little Florence company of Goldfield has made arrangements with the American S. & R. Co. for the receipt of all the high-grade ore that can be shipped over the railroads to Denver; over 2000 tons of ore on the dump are said to contain an average of $250 per ton.——The plant of the Goldfield Chlorination Mill Co. near Columbia is rapidly nearing completion.——At a depth of 500 ft., the Kansas City lease on the Velvet claim is said to have penetrated an orebody 12 ft. wide, chiefly low-grade, but displaying some rich seams.——German miners have secured a lease on the Milltown Fraction claim and will soon begin work.——The shaft of the Gotwaldt lease at the Combination mine has reached sulphide stringers that yield assays as high as $20 per ton; it is expected soon to find the extension of the famous old Reilly pay-shoot.——The Oddie-Gardner mill is to be used to treat ore from the producing leases in the new Stimler district.——Plans are under way for the building of a copper matte smelter at Mina; some of the prominent mine owners of Goldfield and Tonopah are said to be interested in the project.

A new copper district has been found near Luning; many locations have been made. On the Green Mystery claim, a 20-ft. shaft has been sunk in a lode whose outcrop is 60 ft. wide. The shaft, it is said, exposes two feet of ore which carries 10 to 12% copper, 8 oz. silver, and $2 gold per ton.—— The mines of the Goldfield district will have to pay $197,830.33 bullion tax. This tax is at a rate of 4.77% of the net receipts of the mines. All of it goes into the county treasury except three-fourths of one per cent, which goes into the State treasury.—— Twenty stamps are dropping in the Pittsburg-Silver Peak mill at Blair; it is expected that the entire 100 stamps will be in operation soon.——At the Garfield mine three carloads of ore running in value from $50 to $600 per ton have recently been taken out; about 25% of the value is in lead. A cyanide plant is to be erected soon.—— The control of the Nevada-Alpine mine at Lone mountain has passed into the hands of J. S. McCord & Co., Philadelphia brokers. The property will be under the management of S. A. Brady, superintendent of the Belmont mine. The Nevada-Alpine is a lead-siver mine; much ore has been shipped from it.

NYE COUNTY.

The Tonopah Mining Co. has issued a statement covering the operations for the last quarter. The mill was closed about ten days to permit of a change in fuel from coal to oil, which change should reduce considerably the cost of operation. The mill was also closed down for about a week on account of a strike on the railroad. The recent fall in the price of silver decreased the company's earnings during the past three months to the extent of about $40,000. However, the net earning of the company for September, October, and November amounted to $305,526.64.

The ore shipments over the Tonopah & Goldfield railroad for the week ending Jan. 2 as reported by the Western Ore Purchasing Co., were as follows: Tonopah company, 285 tons; Jim Butler, 53; Tonopah Extension, 111; Midway, 189; total, 638 tons. The Tonopah company sent 2160 tons, the Belmont company 800 tons, and the Montana Tonopah 1100 tons to the mills. Thus the total output of the Tonopah mines was 4698 tons of an estimated value (the shipping ore being valued at $70 per ton and the milling ore at $30 per ton) of $166,460.——Plans are being drawn for a stamp-mill of 300 tons daily capacity at the Tonopah Extension mine. The pulp from the batteries is to be reground in tube-mills and then cyanided under air pressure in rotating barrels.——By driving a cross-cut north on the 800-ft. level of the Midway mine, a large low-grade vein has been found at the contact of andesite and dacite; it is not yet possible to correlate it with any other vein in the Tonopah district.——The Montana mine is developing below the 765-ft. level and as there is no geological reason why ore should not be found below the dacite intrusion that has given so much trouble in Tonopah mines, the result of this work will be of great benefit to the district.——The Jim Butler mine is producing the customary quantity of ore; the new compressor is working satisfactorily and rapid progress is being made on all levels.——The Quincy Mining Co. intends shortly to resume operations at its mine near Crow Springs.——At the property of the Washington-Nevada Mining Co. on Lone mountain driving on the lode has been in progress for several weeks; the ore carries lead, silver, gold, copper, and zinc.——The Tonopah Mining Co. has discontinued shipping ore to the smelters, but the mill will be run without interruption to its full capacity of 350 tons per day.——At the Manhattan Pine Nut Extension mine an 18-in. vein of ore has been found; there is also on the property a 30-ft. shaft the bottom of which is in ore carrying $7 per ton.——At the Tip Top mine high-grade milling ore has been developed; there is also a narrow seam of very rich ore, showing much free gold.——The Davis-Shea lease on the Union No. 9 claim at Manhattan is producing much high-grade ore; the lessees are doing all in their power to get this ore out rapidly and are employing every man that they can make room for.——J. W. Travers is preparing to begin development work on the tungsten-bearing lodes of the Round Mountain-Philadelphia and Round Mountain-Nugget groups of claims which lie east of the town of Round Mountain; the ore also contains gold.

The cross-cut on the 200-ft. level of the Mineral Hill mine

at Manhattan cut the lode on December 14. The ore is five feet in width. Assays of $24.64 and $109.36 gold per ton were secured from it. The best ore is in the centre of the lode. The gold is largely free but the vein also carries sulphides. Good gold pannings were obtained across the entire width of the vein in a cut 200 ft. west of the shaft.——The Smuggler Mining Co.'s shaft at Atwood is down 60 ft.: it has yielded some fine ore.——At the Gold Crown mine a gasoline hoist is being installed. As soon as the mine has been cleaned out, hoisting ore will be resumed.——At the Gold King mine the timbering of the shaft has been completed; a good body of ore was developed by this shaft.——The Pactolus mine is being worked by lessees; they have on the dumps about 100 tons of shipping ore and 250 tons that will average it, it is expected, about $25 per ton.——At the Tecopa mine it has been found necessary to reduce the tonnage produced; this gave rise to a rumor that the mine had closed. It is the intention of the company to construct a spur from the mine to Tecopa siding of the Tenopah & Tidewater R. R.; also to erect a smelting plant; to build first a 500-ton unit and ultimately to increase the capacity of the plant to 1000 tons.——The Nevada Smelter & Mines Corporation has installed a large Snow station-pump on the 400-ft. level of its mine at Tybo; a 100-hp. boiler and a 6-drill Ingersoll compressor have also been added to the plant. The mine has been cleaned and prepared for stoping the rich ore that has been found on the 300 and 400-ft. levels; this ore carries silver, lead, and gold.——A contract has been let for the building of a 50-ton mill at the Patton-Paul-Rule lease at the Round Mountain Daisy mine.——At the Homestake mine in the Bullfrog district 40 men are engaged in preparing the foundation for the mill.——Osbourn & Williams are sacking high-grade silver ore at their mine four miles southeast of Round Mountain. Some of it is said to contain a sulphide of copper, bismuth, and lead. The clean-up of the Sunnyside mill for November, it is stated, was nearly $20,000.——Work in the western portion of the McNamara mine has continued during the lawsuit which has prevented work in the remainder of the property; a 60-ft. raise has been made in a vein four feet wide, containing ore of shipping grade.

WHITE PINE COUNTY.

At least two weeks more must elapse before the three imprisoned men in the Alpha shaft of the Giroux property can be brought to the surface; all the ground encountered by the rescuers in the shaft to a depth of 569 ft. had been loosened by the shifting of the timbers and earth which caused the cave-in. On Jan. 1, 400 ft. of earth intervened between the entombed men and liberty.—— For three months ore from the mine of the Boston-Nevada Gold Mining Co. at Osceola has been milled in the Whitney 20-stamp mill.—— It is reported that 45 men will soon be put to work on the big tunnel which is to convey the water of Duck creek through the range to the smelter at McGill.

OREGON.

JOSEPHINE COUNTY.

A notable increase in equipment has been made at the Simmons, Cameron & Logan placer mine in order to handle the deep gravel deposits on the property.——At the Baby mine, near Jump-off-Joe creek, a small force of men is working; a 5-stamp mill is in operation.——At the Lucky Bart mine J. E. Kirk and son are preparing to make another mill-run.——J. H. Beeman is doing development work on the Alice mine.——At the Hinkle mine Bart Carter and Fritz Hammersly are preparing for a test run of ore at the Bart mill.——The stamp-mill at the Tin Pan mine has been completed.——At the Buzzard group of mines a contract has been let for a 100-stamp mill, which is to be completed within six months.——A Kent crushing mill of 100 tons daily capacity and a cyanide plant of the new Rankin type are to be installed at the Elk Creek gold mine.

WASHINGTON.

FERRY COUNTY.

(Special Correspondence).—The Insurgent Gold Mining Co. has leased the Insurgent group of claims to Wm. M. Crummer for six months; the lessee has made a shipment of 35 tons of ore of a value of $18 per ton, of which $15 was gold.——The face of the lower drift of the Copper King mine at Keeler is reported to be in high-grade ore.——The new adit at the Copper Key mine is over 150 ft. long and shows small stringers of low-grade vein-matter; progress is reported at about 9 ft. per day. Another adit, to cut the vein at an additional depth of 195 ft., has been started.—— The Colville M. & S. Co. is pushing work on the Mountain Boy and Summit adits; the latter is intended to develop the vein at a depth of over 700 ft.——A contract has been let by the Silver Tip Consolidated M. & S. Co. to drive an adit 200 ft. long on its property on Iron mountain.

Republic, Jan. 2.

OKANOGAN COUNTY.

(Special Correspondence).—An electric locomotive has been placed in position in the long bore of the Palmer Mountain T. & P. Co. at Laomis; the mill is nearly completed.——The Nespelem Central Mining Co. has installed an electric fan and drilling machinery at its mine in the Colville Reservation. Ore recently found in the mine assayed about $51 per ton.——The Mareus D mine lately produced 20 tons of high-grade ore from the first level. The shaft is being sunk to a depth of 150 ft. A wagon road three miles long has been constructed from the mine to the Okanogan river.

Republic, Jan. 2.

CANADA.

BRITISH COLUMBIA.

The Grand Forks Smeltermen's Union No. 180 and Phoenix Miners' Union No. 8 arranged to resume work at the smelter and mines of the Granby Consolidated M. & S. Co. the day after Christmas; owing to the impossibility of immediately reorganizing the force, only 25 men were accepted on Dec. 26, 75 on the succeeding day, and in a short time over 800 men will probably be employed by the company. The scale of wages adopted is about 50c. per day lower than that prevailing when the mines closed on Nov. 11.——The output of the Rossland mines for the week ending Dec. 21 was as follows: Centre Star, 4652 tons; Le Roi, 2084; Evening Star, 30; total, 6766 tons.—— Since adding 10 stamps to the mill at the Queen mine, near Salmo, 55 men have been employed on that property.—— The Canadian Zinc Co. expects to have its electric zinc-reduction plant completed about Feb. 15; it will be the first of the kind on the continent.—— At the Stemwinder mine, in the Similkameen district, rich ore has been found on the 500-ft. level.——The Whitewater mill has reduced its consumption of ore to 280 tons daily.—— The ore shipments in the Cranbrook district for the week ending Dec. 28 were as follows: St. Eugene, 479 tons; Sullivan, 600; North Star, 64; total, 1143 tons.—— Ten men are working on the 225-ft. level of the Crescent mine at Skylark.—— The completion of the tramway at the Hewitt mine, near Slocan lake, is being hurried so that ore may be sent to the mill as soon as possible; it is intended to transport 100 tons per day.——At the Maggie mine a new lode containing 24 in. of clean galena has been found in sinking the shaft.—— In crosscutting the Reco-Goodenough lode a streak of ore 11 in. wide has been found, but it is of much lower grade than the ore formerly shipped from this property.—— At the Bluebird mine good galena ore 20 in. in width has been developed; a carload of it has been sacked for shipment.

The ore shipments from the Rossland mines for the week ending Dec. 28 were as follows: Centre Star, 2840 tons; Le Roi, 1680; Le Roi No. 2, 431; Evening Star, 37; Bluebird, 40; total, 5028 tons. At the Trail smelter there was received during the week ending Dec. 28, 4872 tons of ore. Besides that sent from the Rossland camp, shipments were received from other mines as follows: St. Eugene, 804 tons; Silver King, 11; Whitewater Deep, 21; Reco, 47; Vancouver, 21; Granite, 40; Hewitt, 21; La Plata, 165; Sunset, 21 tons. At the smelter of the Le Roi Mining Co. at Trail shipments were received as follows: Le Roi, 1680 tons; First Thought, 109; total, 1789 tons. The total shipments from the Rossland and Slocan-Kootenay districts during 1907 were 1,608,048 tons.

Special Correspondence.

Johannesburg, Transvaal.

Diamond Schemes that Went Wrong.—Exodus of White People.—Mineral Production.—Base Metal Mining.—The Industries Commission.—Future of the Country.

It looks as if some of the shady diamond propositions that have been organized to fleece a gullible public were "coming home to roost." The Ebenezer diamonds went through the winding up process the other day. The investigation committee appointed to examine into the doings of Beresford diamonds was not able to prove the allegation that the property had been salted. "Gross misrepresentation" seems to be the verdict of this jury. One crime is as bad as the other, and today this enterprise, whose shares reached a high figure, are practically worthless. But the worst impression has been made by Dr. Carstorphine's report on the Robert's Victor diamond mine. Dr. Carstorphine is an honest and able geologist, with wide South African experience, who was commissioned to make a thorough examination of this property, which was looked upon as a thoroughly sound proposition. His report is disconcerting. The original area of the mine was stated to be 102 claims. To be conservative, so it was stated, this estimate was cut down to 99 claims. Dr. Carstorphine's report shows that there must have been more "gross misrepresentation," for he gives the area of the mine as 57 claims. Robert's Victor shares, which were boomed up to £14, now stand at £2. Through this "gross misrepresentation" by the mine managers, much money must have been stolen. Of course the culprits should be in jail, but they are not. These fraudulent enterprises do an incalculable harm to legitimate mining, and do a great deal to keep capital, which is so needed for the development of South Africa, out of the country.

The exodus of white people from South Africa continues. In the past 21 months about 26,000 people have left the country. In a recent speech the Premier of the Transvaal, General Botha, declared that what the whole of South Africa wanted was a large white population. It is therefore rather distressing to know that instead of the whites increasing they are steadily leaving the country. Under the circumstances the best thing that a white man out of employment can do is to leave South Africa, if he has sufficient money. Little headway is being made in solving the problem of the unemployed. Many white men are working hard for the municipality at wages that can only be considered starvation. People are beginning to state that legislation must be introduced to protect the white man. No doubt this will be one of the recommendations of the commission now taking evidence in Johannesburg. What form their recommendation will take is difficult to say. Some people advise passing a law prohibiting the Kaffir from doing skilled labor on the mines, on the lines of the Chinese Labor Importation Ordinance, which distinctly protects the white man from the Chinaman.

The following particulars of minerals (other than gold, coal, and diamonds) produced in the Transvaal during the month of October, 1907, is of interest:

	Tons.	Value.
Copper ore	101	£3,250
Galena "	151	1,573
Tin "	66	1,980
Miscellaneous (asbestos, graphite, mercury, zinc blende, etc	103	1,488
Lime	2,322	4,576
Total value		£12,867

Compared with the returns for September (the value of the base metals having been declared at £19,966) the figures for October show a big drop. Almost all this decrease is accounted for by copper. There is no doubt that the high market values of the base metals stimulated the work of exploitation, but now that copper has had such a serious fall, and with it zinc and lead, the development of base metals will be seriously checked. In an expensive country like the Transvaal the prices of metals must be very favorable before people feel inclined to go in for copper, lead, and zinc.

Quite contradictory evidence is being given before the Industries Commission now sitting at Johannesburg. This commission has been appointed for the purpose of inquiring into the possible extension of industries in the Transvaal. The evidence given by the working men is a strong plea for protection, while the arguments presented by the Chamber of Mines is an uncompromising request for free trade. Self-interest seems to dictate the evidence so far given. From the workman's point of view, protection is required for the Transvaal, while the Chamber of Mines people will benefit most from free trade. It is to be hoped that a fair compromise will be effected, and that any industry with a chance of success in the Transvaal will be helped in every way. Year by year the gold reserves of the Rand are growing less, and statesmen fully realize that if the gold does not help to develop the country, the Transvaal in twenty-five or thirty years will be like a sucked orange.

London.

Coalite.—A Smokeless Fuel.—Conditions in England.—An Interesting Invention.—Wood Pulp and Mining in Newfoundland.—Tanganyika Concessions.—Important Copper Enterprises.

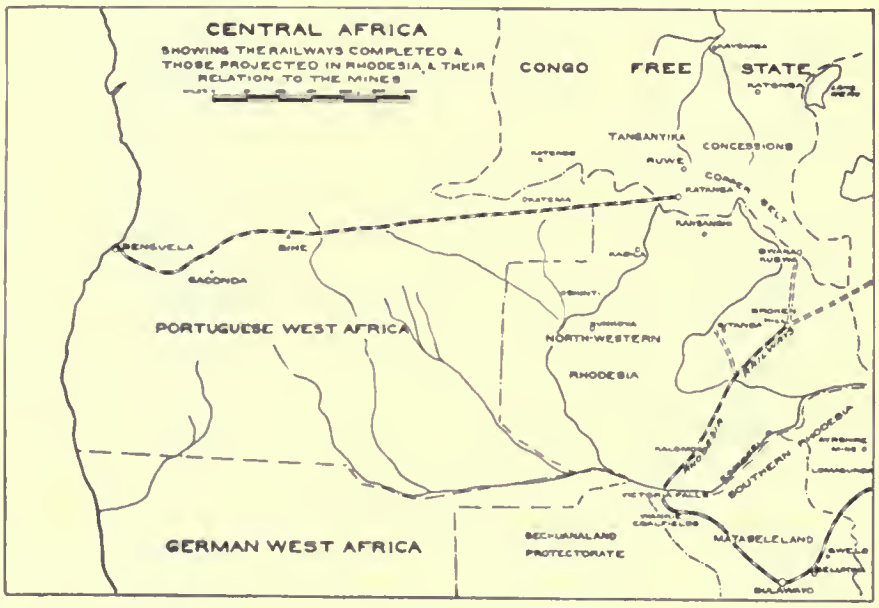
During the early part of 1907 a great deal was heard in London of the new fuel Coalite and in June the public was invited to subscribe for the capital of a company formed to manufacture and sell it, called British Coalite Limited. The shares were not taken up freely by the public, and the underwriters were saddled with considerable liability. At the time, the information published as to the nature of the fuel and the process employed was scanty, and such facts as became public were unofficial or were supplied by the opponents of the scheme. The patents describing the process have been published, one of them a month ago and the second this week; it is therefore opportune to say something about the subject at the present time. Briefly, the idea is to partially coke a bituminous coal, so that it will burn with a bright smokeless flame in an open grate. In England the closed stove and the steam or hot-air pipe are not popular, and though gas has to some extent displaced solid fuel in the cooking ovens, the open grate continues to be used for heating purposes. England is a country subject to mists and fogs, and when the air is still, the smoke from the chimneys hangs in a dark sulphurous cloud. In the manufacturing towns of the North of England most of the black fog is caused by the manufacturers' chimneys. In London there are very few works and factories, and such as do exist are forced by law to burn the best quality of South Wales smokeless coal. The London black fog is caused almost entirely by house-fires. It was the idea of the inventor and promoters of Coalite to appeal to the London householders and encourage them to use a fuel that was guaranteed to give no smoke and yet to burn perfectly freely in an open grate. As already mentioned, the details of the manufacture and the actual nature of the fuel were not disclosed, and the matter was wrapped in some mystery. There were many guesses published, and some articles appeared in the press written by coke and gas-makers, giving the

opinions of rivals as to the validity of the unpublished patents. It is not until the last month, when the two patents were published, that any reliable opinion could be given. The patentee is Thomas Parker, a well known engineer and electrician, and the patents are numbered 14365 and 17347 of 1906. Essentially the claim is for a hard and smokeless fuel produced from bituminous coal by a process of partial destructive distillation, the heat being gradually increased to a temperature of 800° F and maintained at this temperature until the illuminating gases cease to be evolved, after which steam is introduced for the purpose of removing the sulphur as much as possible and of reducing the temperature to some extent before discharging the retorts. The specifications give some details, but only of a meagre kind, as to the nature of the apparatus and plant, but these do not really matter, as the patent is for the fuel itself and for the method of the process, rather than the plant. The process also includes the working up of by-products, such as the illuminating gas and pitch.

The chief point of the process appears to be that the coke made is just hard enough for handling, and for use on a small fire, and will burn freely in an open grate without any draft. The low temperature used in coking causes sufficient bituminous matter to be retained and produces a texture soft enough to make the fuel burn easily. It is probable that the smokelessness is obtained as much by the swelling of the coal and the porosity of the fuel, so bringing a larger surface for contact with the air, as by the partial driving off of the bituminous matter.

Coalite does not differ greatly from the old metallurgical coke used a hundred years ago; this was soft and semi-bituminous, and was not made at very high temperatures. Modern metallurgical coke is made at high temperatures, so as to produce a fuel strong enough to bear the burden of large blast-furnaces, and the coke obtained as a by-product in gas manufacture is just as hard, because a high temperature is used for the purpose of obtaining a large quantity of illuminating gas from the fuel. The production of Coalite seems to me to be a reversion to the days before hard coke was invented. The inventor and the company certainly deserve success in founding a big industry in smokeless fuel, but it is difficult to say definitely that their patents are unassailable.

During the past few weeks some curious reports have been circulated in London with regard to the proposition of the Amalgamated Press Ltd. to use its reserve fund for the prosecution of mining ventures. This, of course, is a wild story. The Amalgamated Press is the company owning the Harmsworth publications, the *Daily Mail*, the *London Magazine*, and a whole host of weekly and monthly publications. The company is prosperous and pays good dividends. For some years the directors have foreseen the coming scarcity of wood pulp and the consequent rise in the price of paper, owing to the prodigal way in which the spruce fir is being used up. They therefore looked out for a tract of country for themselves where spruce can be grown on scientific principles and where paper could be made on the spot. Newfoundland was fixed on, and after exhaustive tests of the quality of paper made from the trees growing there and of the possibility of seeding and replanting trees, a large tract of country, covering over 2000 square miles, has been acquired. A new company called the Anglo-Newfoundland Development Co. was formed in order to exploit the forests and erect paper factories. It is proposed that other publishing companies shall join in the scheme and take part of the shares. The brothers Harmsworth also are taking shares personally. The Amalgamated Press is to use the reserve fund of the company in subscribing for capital in the Anglo-Newfoundland, as it is considered best to apply the fund in this way instead of investing in depreciated Government securities. Besides, the present is not a suitable time to ask the public to subscribe to new shares. Many of the preference shareholders in the Amalgamated Press objected to this use of the reserve fund, and stopped at nothing in opposing the scheme. Hence the rumors that the reserve fund was to be invested in wild-cat mining schemes. In most rumors there is generally a basis of truth, and this case was no exception. The facts are that in examining and developing the forest lands, traces of mineral outcrops were found, and with a view to turning every opportunity to account, the directors asked John Taylor & Sons to send a mining man to the spot to make an examination. Rowland Feilding went out accordingly and is directing development work. The deposit on which most work has been done contains mixed lead and zinc ores, and its commercial value is not yet fully ascertained. Within the last few weeks some copper outcrops outside the company's tract have been discovered and the land acquired. Newfoundland is somewhat of a neglected country, although mineral deposits are known to exist there.



The reports of the Consolidated African Copper Trust and of the Tanganyika Concessions have been published this week and give some information regarding the properties in Rhodesia about which a good deal has been heard during the last five years. It is a disappointment to find that the Tanganyika report contains no reference to R. J. Frecheville's recent visit. There is no mining engineer who is a better judge of a mine than Mr. Frecheville and people in London were keenly on the lookout for his opinion. It should be remembered, however, that he was not sent out by the company but by other people who were contemplating the investment of capital in the scheme, so the company has no say in the publication of his report. It is probable, however, that his opinion will become public property before long. Your readers may remember that the country owned by this company was explored and acquired by Robert Wil-

liams. In the early stages the reports were so glowing both as regards the extent and richness of the deposits that some of us were coldly critical. As time went on it was found that every mining man who visited the district came back considerably impressed. I have in my possession some specimens, and I have seen the bulk samples. The ore is massive chalcopyrite and pyrite mixed and contains about 6% copper, in many cases more. The report of the Consolidated African Copper Trust contains some interesting information as to the progress at the Edmundian mine. The ore deposit has been extensively opened up and veins 30 to 36 in. wide, assaying from 10 to 20% copper, have been proved over considerable distances. At one point the vein is 7 ft. wide with indications that it will prove a lenticular mass. Arrangements have just been completed for the building of reverberatory furnaces. The concentration of the ore is to be effected by the Elmore vacuum process, which is now coming forward in a most interesting way.

Butte, Montana.

Copper Production.—Smelter Rates Raised at East Helena.—Transfer of Control in the Stewart.—North Butte Affairs.

The estimated copper production in the Butte district during 1907 is 240,887,516 lb., as against 342,688,809 lb in 1906, a decrease of 101,801,293 lb. Each month of the past year showed a decrease from the corresponding month of the preceding year, but the big falling off came with the sudden decline in the price of copper and the rapid curtailment of production by the Amalgamated Copper Co., beginning in August. From a normal production of 30,000,000 lb. per month the yield fell to 7,000,000 or 8,000,000 lb., and during the last month the Amalgamated mines, with the exception of those of the Boston & Montana Co., were closed entirely, and so were the mines of the North Butte and Butte Coalition companies. The Clark mines reduced their production 50%, and the only company operating in the Butte district that produced more copper than it did in 1906 was the Pittsburg & Montana, a small concern with a daily output of about 150 tons of ore. The estimates of production for 1907 are as follows:

Company.	Pounds of copper.
Boston & Montana Co.	63,053,655
Anaconda	64,154,636
Butte & Boston	9,209,650
Washoe	6,438,420
Parrot	5,403,010
Trenton	6,794,475
North Butte	29,534,240
Butte Coalition	24,971,800
Original (Clark)	17,296,940
Pittsburg & Montana	4,785,090
East Butte	3,965,480
LaFrance	2,168,975
Miscellaneous	3,111,145
Total	240,887,516

Montana mining men, outside of the large companies, are up in arms against the action of the American Smelting & Refining Co. in raising smelter rates at the East Helena smelter. It is claimed that the new rates are "exorbitant and confiscatory." The new rates went into effect on December 1. A heavy penalty has been placed on silicious ores, and iron ores alone can be treated at a reasonable figure. Already a number of mines have been compelled to shut down because of the new rates, and others will probably have to suspend. The East Helena rates, following the shut-down of the Washoe plant at Anaconda, and the suspension of the independent smelters in Utah, competitors of the East Helena plant, is a hard blow to the mine operators. They claim that the new rates are an advance of fully 50%. Silicious ores that were treated at the Washoe smelter at a maximum charge of $7.50 per ton will cost from $15 to $22 at East Helena. Where the Washoe smelter paid for anything over 50c. in gold, the East Helena smelter will pay for nothing less than $2 in gold.

The North Butte has made a temporary arrangement with the Butte Reduction Works, owned by the Original Mining Co., a Clark company, and the latter will for a time treat some North Butte ore. The North Butte has therefore resumed mining in a small way and is shipping from 200 to 300 tons per day to the reduction works. For what period the arrangement has been made can not be ascertained, but the capacity of the plant is large enough to take care of the Clark production and the present production of the North Butte. However, the Original mine is closed for repairs and one report is that the reduction works will receive North Butte ore only until the Original resumes production. Still, the Clark mines have not been run to capacity for four or five months, the output being limited to about 40% of the normal, and until the normal condition is restored the smelter may be shared with North Butte.

The report comes from Wallace that F. A. Heinze has probably sold his interest in the Stewart mine to the Bunker Hill & Sullivan Co. The Stewart has been in litigation with the Cœur d'Alene Development Co., a concern closely allied with the Bunker Hill people, and engineers of the Bunker Hill Co. recently made an examination of the Stewart. Upon that came the announcement that the Stewart would resume operations in a few weeks, which is said to indicate a Bunker Hill ownership, as that company is operating its properties to capacity while the other producers are curtailing on account of the drop in the price of lead. The trouble with the Cœur d'Alene Development Co. appears to have been settled, for that company, on whose ground the Stewart mill is situated, has agreed to permit the Stewart to resume operations on the mill.

Wallace, Idaho.

Output of the Coeur d'Alene.—Dividends Increase.—Tonnage Produced.—Severe Effect of Lower Metal Prices.—Expectation of Recovery.—Future Prospects.

In spite of the decline in the metal markets and the shutting down of several of the large mines, dividends exceeding those of 1906 by $31,500 have been paid by the big producers of the district. The total amount paid is as follows:

	1906.	1907.
Bunker Hill & Sullivan	$2,340,000	$1,980,000
Federal M. & S. Co	2,040,000	1,710,000
Hercules (estimated)	720,000	1,052,000
Hecla	450,000	520,000
Snowstorm	90,000	360,000
Success	20,000	60,000
Monitor	.....	9,500
Total	$5,660,000	$5,691,500

Under the present owners the mines of the Cœur d'Alene have now paid in all $21,017,500 in dividends and under previous owners $11,501,307 making a grand total disbursed of $32,518,807. This is distributed among the different mines as follows.

	Paid under previous owners.	Paid under present owners.
Bunker Hill & Sullivan	.....	$9,846,000
Federal M. & S. Co	$8,488,307	6,310,000
Hercules	.....	2,772,000
Hecla	.....	1,520,000
Snowstorm	600,000	450,000
Frisco	1,723,000	.....
Pittsburg	90,000	.....
Monitor	.....	9,500
Success	600,000	80,000

The ore shipped from the district during 1907 is estimated at 343,125 tons, the maximum shipments being in

March (with 41,170 tons) and the minimum in December, when only 15,000 tons were produced. The total is practically the same as for last year. Throughout the whole of 1906 the mines were worked to full capacity and for the first few months of 1907, owing to the fact that the price of lead reached a higher figure than for 25 years past. Throughout January, February, March, and April the price of lead was six cents and the average price of lead throughout the whole year is only two-thirds of a cent below the average quotations for 1906. At these figures the crude value of the ore shipped from the Cœur d'Alene is roughly $20,000,000. Since 1900 the mines have shown a rapid increase of production with a

Map of Idaho.

corresponding increase of net earnings. In 1901 148,890 tons of crude ore and concentrate were shipped to the various smelters; in 1902 the shipments were 160,310 tons; for 1903, 200,596 tons; for 1904, 274,000 tons; for 1905, 316,000 tons; for 1906, 344,000 tons, and about the same for 1907.

Had it not been for the decline in the metal markets during the past few months of the present year the tonnage would have surpassed that of 1906, but the closing of the Morning mine at Mullan, the second biggest lead-producer in the district, the Snowstorm, the Success, and several smaller mines, has cut the production during the last month or two severely.

The value of the lead-silver ore and concentrate shipped to the smelters during 1907 was $64.95 per ton, while the Snowstorm copper ore averaged about $20 per ton, as sent direct from the mine without concentration. The total shipments will be about 344,000 tons, of which about 286,000 will be lead-silver ore and concentrate, the balance being copper ore from the Snowstorm, Monitor, and the smaller copper producers. The value of the lead shipments is roughly estimated at about $14,200,000 containing $4,250,000 worth of silver. The copper ore is valued at $1,000,000, containing silver and gold to the extent of $300,000, making a grand total shipped from the district of about $20,000,000.

The outlook for the present year is excellent and it is expected that several new mines will become productive. Among these there is every reason to believe that the Stanley, Rex, Surprise, Idora, Stewart, Pittsburg, Charles Dickens, Nabob, and Tamarack & Chesapeake will reach the dividend stage provided that the metal markets recover. With the completion of the Idaho Northern the output will be increased enormously by mines on the northern side of the district.

Salt Lake, Utah.

Mine Operators Organize.—Smelter Rates Raised.—The Smoke Litigation.—Lead Output Suffers.—New Concentrators at Garfield.—Shipments from Tintic.—Coal Production.

The mine owners of Utah will probably form an organization. Such a movement has been in contemplation, and since the late attempt of local smelting companies to raise their treatment charges with additional penalties, the movement has rapidly taken form. Utah producers have been confronted with some serious problems lately, but by thorough organization and promptness of action, they hope to overcome the evils that threaten to cut down their profits or force them out of business entirely, particularly the owners of the smaller mines. For some months the charge has been made that competition in the local smelting field was practically at an end. There seems to be a perfect working alliance between the American Smelting & Refining Co. and the United States Smelting, Refining & Mining Co. with respect to the making of new ore contracts or the renewal of old ones. Producers who had no contract, but who had been accustomed to entering the open market with their product, were informed that their ores were not wanted at any price, and several instances have come to light where the product has been unloaded from the cars and left at a convenient place near the sampling mills, in the hope that conditions would right themselves and the product become marketable. Other instances have been noted where the smelting companies have not only sought to exact higher charges and penalties, but have interposed a clause in contracts, which when operative would give them one-half the profit above a certain fixed basis. This was too much; and the result has been that very few contracts have been signed by the producers, opposition being almost unanimous.

This has led to an independent smelter movement; that is, many of the producers have subscribed to the project originally planned by F. Augustus Heinze. This smelter is now assured, the site has been secured, and it is expected that the breaking of ground will begin within ninety days. The new plant will be equipped with both lead and copper furnaces. In addition to this, the lead-silver ore producers of the Tintic district will find relief in the construction of the new smelter of the Tintic Smelting Co., which is now being constructed. This plant will be ready in April, and there is a probability of the plant of the Utah Smelting Co., at Ogden, being started up again right away. The Ogden smelter was shut-down several weeks ago after a run of three or four months. The company purchased ores when metal prices were high, and came to grief when the market collapsed.

The copper smelters at Murray and Bingham Junction, involved in the injunction from the Federal Court, are practically out of business. The plant of the Bingham Consolidated closed on the day following Christmas;

the fires were drawn from the last furnace of the Utah Consolidated on the night of the 4th inst., and the United States Smelting Co. has notified all shippers that no more consignments will be received at either of its Bingham Junction plants; that it is the intention to close them down. This company has about five weeks' supply of lead ore on hand, and about three weeks' supply of copper ore. The victory of the farmers is complete. The smelters have been declared a nuisance if erected within a farming community. The Garfield plant of the American Smelting & Refining Co., however, is not involved in this decree. The plants that have been compelled to move will be re-built in Tooele county, within 30 miles of Salt Lake City.

While production from Utah lead mines has been practically suspended for the time being, many of the copper mines are being operated. Notable among them is the Utah Copper and Boston Consolidated at Bingham and the Cactus mine in Beaver county. The Utah Apex, Utah Development, Utah Consolidated, and Ohio Copper, however, are on a development basis. Eight sections of the new mill of the Utah Copper Co. at Garfield, are now at work. The management reported a production of 3,000,000 lb. of copper in December. The mill of the Boston Consolidated at Garfield has been given a trying out and within the present week the first section will be in regular operation. Three sections of the plant are ready. The St. Joe Mining Co. has been placed in the hands of a receiver. It owns property at Bingham upon which little development has been performed in late years owing to litigation pending between the majority and minority interests.

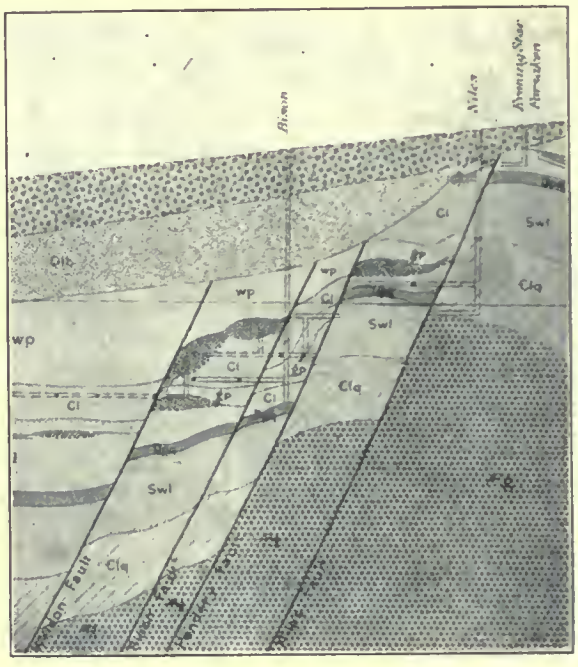
The ore shipments from the Tintic last week came from the following mines: Bullion Beck, 3; Beck Tunnel, 1; Colorado, 5; Centennial Eureka, 36; Eureka Hill, 5; Mammoth, 7; Scranton, 4; Tintic Iron, 10; Yankee Consolidated, 21 carloads. The annual report of the Coal Mine Inspector has been filed with the Governor and shows a production of 1,967,621 tons, or a gain of 128,432 over 1906. The output by counties is as follows: Carbon, 1,816,133; Summit, 73,918; San Pete, 4500; Emery, 2562; Morgan, 421; other small mines, 70,117 tons.

Denver, Colorado.

Gold Sovereign Directorate.—Land Frauds.—Production of Precious Metals.—Coal Output.—Mining at Leadville.

The dissatisfied stockholders of the Golden Sovereign Mining & Tunnel Co. got together at their annual meeting on Jan. 2 and ousted Abraham Rapp and his board of directors. O. H. Hinds, who led the opposition, was elected president and general manager, and an entirely new board of directors in sympathy with him was put in control. The stockholders also voted to rescind the recent acts of the Rapp management. This means that the lease granted to the Franklin Leasing Co. a few days ago will be cancelled and the three-year ore contract with the Golden Cycle mill at Colorado City will be reconsidered. It is the expressed intention of the present management to operate the mine on company account.——The Department of Justice, which has been prosecuting several cases of alleged frauds in connection with the coal-lands investigation, has received several adverse decisions recently in the Federal Court at Denver. Judge Lewis has given his decision that the present laws do not cover the case as taken up by the Government. He maintains that a man may promise to sell his allotment before he has received it without violating the law. This decision upholds the 'dummy entry' system. The cases will, of course, be carried to the higher court.

At the present time several estimates of the gold and silver production from Colorado for 1907 are current. Some of the estimators seem to be affected by the altitude. The preliminary report of the Director of the Mint credits Colorado with $20,888,833 gold and $7,687,796 silver. This ranks Colorado as the greatest gold-producing State and third in the production of silver. The falling off in the production of gold is $2,321,796. Whatever shortage does appear in the final figures may be attributed in large part to the burning of the Golden Cycle mill and the closing of several of the mines in the Cripple Creek district as a result. In general, the year has been free from labor disputes. The insufficient smelter capacity of the various plants and the recent financial disturbance may have had a slight effect. But one factor which must be recognized is the excessive operating costs due to high prices for labor and supplies. The rate of wages cannot be reduced without starving



Typical Leadville Geology.

the laborer, but with the present conditions only the high-grade propositions can be handled with profit unless they are of exceptional size.

Cripple Creek produced $13,074,992 in gold during the past year and would have materially increased this amount had there been adequate milling facilities throughout the year. The prospects for 1908 are very promising. The treatment and transportation charges are the most advantageous in the history of the camp. More than 40 new discoveries in old mines or prospects have been reported. Every property that has any indications of value is being opened and the camp has an abundance of skilled miners. There are now 12 mills operating in the camp. Most of them were started as experiments and have proved successful. These mills are estimated to have treated 113,675 tons during the year at a saving of about $600,000.——Since the closing of the mines in the down-town district of Leadville, most of the effort has been toward development and prospecting. The estimated production for 1907 is $10,906,128, which shows a loss of $692,590 from the figures given by the United States Geological Survey for 1906. A notable gain, however, was made in the value of the gold, copper, and manganese ores. The loss appears in the value of the silver, lead, zinc, and bismuth produced. The loss in the latter metals is due largely to the fall in prices.

Concentrates.

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

AN efficient pipe-wrench for pipes no larger than 6 in. diam. consists of a file, cold-chisel, and monkey-wrench. For large pipes take about 4 ft. of rope, fray both ends thin and put them together; commence with tip ends and wrap tightly around the pipe until a loop is made; then, with a piece of pipe or a round bar for a lever, turn the pipe as you would with a pipe-wrench.

BAILING WATER out of a shaft with the ordinary trap-bottomed bailing-bucket should never be done unless absolutely necessary, especially if there is soft or loose ground in the shaft that is not lagged tight. The unavoidable leakage washes all the loose material out from behind the lagging, loosens the blocking from behind the timbers, and causes loose ground to slab off.

IT IS NOT KNOWN that any attempt has been made to sink a shaft by using churn-drills to put down a series of holes which were subsequently filled with sand and then cleaned out sufficiently to permit blasting in successive sections. It would cost less to sink the shaft in the usual manner. One mining company bored a series of holes with a diamond-drill and shot them, but they had not been put down straight and the result was unsatisfactory.

IN the republic of Panama, the revised mining law requires all claim-measurements to be made on the slope of the ground, and not horizontally, which makes accurate mapping difficult, as the claim-lines swing in and out wherever the topography of the country is irregular. Placer claims are 5000 by 200 metres, containing about 2471 acres, and quartz claims may be made up each of three *pertenencias*, located end to end, each *pertenencia* being 600 by 240 metres, making an area of about 107 acres in each claim so located.

A HYPOTHETICAL MINE in California is opened on a 4-ft. vein of brittle quartz which has well-defined walls and dips at an angle of about 60° from the horizontal; the ore contains from 2 to 3% of sulphides and will probably average by assay $6 gold per ton. It is developed by tunnels. Timber is plentiful in the vicinity and water-power is available. A home company accustomed to California conditions would probably mine and mill the ore from this mine for $2.50 per ton; but it might cost a New York or foreign company $4 per ton.

A MINER may fence in his mining claim, if he wishes, and rent it for any lawful purpose, but the fact that it is used for agricultural purposes might militate against securing title to it as a mineral land, if any controversy should ever arise between a homestead claimant and the mineral claimant as to the character of the land and the purposes for which it was best adapted. The law does not contemplate the fencing in of mining claims, but there is no objection to it, and, as hereinbefore suggested, the question as to whether or not the mineral claimant should rent the land for agricultural purposes is one purely of policy and judgment.

SUCTION-PUMPS with rods inside the water-pipe cause a good deal of trouble when used in shafts, as all the working parts are hidden, making repairs difficult. If wood rods are used, they are apt to pull apart at the points where the metal joints are riveted to the rods. To repair such a break, it may be necessary to remove more than half of the water-column pipe, length by length, and when the break occurs some of the rivets almost invariably drop down into the valves. By the time the rod is repaired, the water may have risen over the valves, which are choked, and the bailing-bucket must be resorted to. Half-inch pipe makes better rods than the usual 2 by 2-in. wood strips.

BARITE has been mined for many years in various parts of Virginia. The deposits of commercial importance thus far developed which have been worked for barite alone, are lenticular masses or pockets in limestone or they occur superficially as loose lumps and nodules of irregular shapes and sizes, imbedded in the residual clays derived by the decomposition of the limestone. Minerals associated with the barite are limonite, sphalerite, galenite, pyrite, and occasional fluorite. The mining of barite in Virginia is surface-work; the greatest depth reached in any shaft is 160 ft. In southwestern Virginia the mining is largely by open-pit work; but in the district east of the Blue Ridge mountain there are vertical timbered shafts and drifts which follow the direction of the orebodies. The ore is washed, bleached, and ground, and occasionally jigged to remove impurities from the better grades of merchantable ore.

INSURANCE AGENCIES have had several inquiries from managers of mining companies who desire to take out a burglary insurance policy on the transportation of their bullion from the mine to the railroad station, against the acts of parties other than the carriers; but the mining companies refused to accept the policies that the insurance companies were willing to write, on account of a clause making them void in case the robbery was done by an employee of the mining company. In California and other Western States bullion is nearly always shipped through regular express companies; they take it at the value placed upon it by the shipper, charge for express-age according to this value and guarantee its safe arrival at the destination. If a mine is situated far from a railroad or important stage route, express companies may refuse to take charge of the bullion. In a case of this kind in Idaho the transportation of the bullion involved a 52-mile stage journey.

A SERIES of experiments for the preservation of mine timber planned in 1906 by the Philadelphia & Reading Coal & Iron Co. and the United States Forest Service resulted as follows: In the destruction of timber by decay, ventilation is a large factor. For wood-destroying organisms to exist, they must have air and water. It is the alternation of wet and dry conditions which produces rot. Seasoned timber is far more durable than green timber and is considerably stronger. From two to five months are necessary for proper seasoning. It may lose from 30 to 35% of its original weight. In durability peeled timber is superior to unpeeled timber; in the unpeeled condition the space between the bark and the wood favors the development of wood-destroying organisms. Timbers treated with creosote and a solution of zinc chloride have very effectively resisted decay. A good penetration of the wood by the preserving fluid from 2 to 5 in. has been easily secured. Timbers treated by the cylinder process are also standing well; but the success of the superficial brush treatment has yet to be proved. On account of their comparative cheapness and ease of application, requiring no plant, they may be of benefit to small operators or in a situation where the timber is likely to be broken. This series of experiments especially applies to the southern anthracite coal region; in places where conditions and species of timber differ, the results of these experiments may not be applicable.

Discussion.

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy.

Depth at Goldfield.

The Editor:

Sir—I notice that in your issue of December 28, Mr. E. G. Tinnebo asks why the mine operators of Goldfield have not proven, one way or the other, the vexed questions as to depths of commercial orebodies in this district, by means of diamond-drills. His letter ends with the question: "Do they fear the results obtained from greater depth?"

It is not necessary that I should enter a defense of the mining methods pursued here, or of the mines; but as Mr. Tinnebo's question has been frequently asked, and always through lack of knowledge of conditions prevailing here, it is time that a definite answer be made.

There have been, to my knowledge, five attempts to drill deep holes here, with core-drills of well known makes—all of them unsuccessful because of the soft and much broken country that must be penetrated. For example, a contract was taken six months ago by experienced drill-men to sink a hole 1000 ft. on a well known property in this district, just east of the present producing belt. At 210 ft., the drill entered soft clayey fault-material and, owing to an accident, the hole was lost. A second hole reached the same depth without much difficulty, but 50 days were consumed in sinking 35 ft. through the fault-material above referred to. This fills the hole rapidly whenever opportunity is given. At present, operations are suspended, casing having been used without success. The contract was taken at $5 per foot for the first 500 ft. The contractors have already lost money heavily and cannot possibly come out even.

Near this same hole, I am developing a property now opened to a depth of 250 ft. In the lower level there are exposed over 35 ft. of fault material which would be exceedingly difficult for a diamond or core-drill to negotiate. The country, being almost entirely made up of weak eruptives, presents many difficulties of the sort and is not at all favorable for economical drill work. This has been repeatedly demonstrated by very competent men in the business.

The question of depth in this district must, apparently, be determined by the slower process of shaft-sinking. Orebodies already exposed justify deeper development, and owners do not seem afraid.

ARNOLD BECKER.

Goldfield, December 30.

Cyanidation of Ore Containing Both Coarse and Fine Gold.

The Editor:

Sir—Regarding your question: "Given an ore containing some coarse gold, as well as gold finely divided, what steps would you take to save the coarse gold, which otherwise will escape solution in cyanide?"

Assuming that this ore does not contain any of the base metals in an amount to cause a high cyanide consumption, I would proceed to mill the ore in a weak cyanide solution (0.05 to 0.1%); passing over amalgamating plates; then classify by screening at practically 100 mesh; re-grind the oversize in tube-mills; again passing over amalgamating plates. After agitation, filter the slime, and precipitate the resulting solutions with a zinc method; zinc dust preferred.

WALTER L. REID.

Telluride, Colo., December 28.

The Editor:

Sir—Answering your inquiry, I would amalgamate first and cyanide the tailing, which is probably the obvious answer to be given, not knowing the peculiarities of the ore, or other conditions which might influence the treatment. For example, I know of an instance of a mine equipped with a mill and an extensive cyanide plant in operation which preferred to grind up some of the ore which contained coarse gold to pass a 40-mesh screen and ship to the smelter in preference to amalgamating and cyaniding. The determining factor was the richness of this ore, which contained between 20 and 30 oz. gold per ton.

E. P. KENNEDY.

Treadwell, Alaska, January 2.

The Editor:

Sir—In reply to your question:

"Given an ore containing some coarse gold, as well as gold finely divided, what steps would you take to save the coarse gold, which otherwise would escape solution in cyanide?"

There are several ways that suggest themselves to me, among which are the following four, given in their order of preference:

1. Crush to 40 mesh, amalgamate in battery and upon apron plates, slime the whole product in Lane mills, and agitate with cyanide solution.

2. Crush to 20 mesh, amalgamate in battery and upon apron plates, size, leach the sand with cyanide solution, and agitate the slime.

3. Crush to 40 mesh, amalgamate in battery and over plates, size, leach the sand, and agitate the slime, both with cyanide solutions, of course.

4. Crush to 20 mesh, size, leach the sand with cyanide solutions, and save the coarse gold on riffles placed in the discharge launders; agitate the slime with cyanide solution.

The matter of evolving the procedure under any one of these headings with the design of the necessary plant, can be perfected by any mining engineer or metallurgist, and need not be gone into at this time. In regard to the Lane mill, which I mention under heading No. 1, I can say that the foundry at Rapid City, S. D., manufactures what is called an improved Lane mill, in two sizes, and I can recommend it as an efficient fine grinder.

E. A. H. TAYS.

Denver, December 21.

The Editor:

Sir—The conditions described in your question probably obtain in the majority of gold mines, and certainly in all districts classed as free-milling; so that it would seem that the answer ought to be found in actual practice. With the same character of ore, approved practice will vary with local conditions, but roughly we may say that to save coarse gold we turn to amalgamation, for fine gold to cyaniding, for combined, alloyed, included, or otherwise rebellious gold, which even in a so-called free-milling ore, may amount to over 40% of the total value, to a variety of methods.

But the question is about the coarse gold. Are we confined to amalgamation, and if so, how shall we amalgamate?

Much of the coarse gold can be recovered by concentration, but the difficulty of sampling the concentrate makes this method objectionable unless the mine is doing its own smelting. Gold mines, however, are not apt to have their own smelters. Chlorination is apparently barred. We must amalgamate.

If the mine be in a district where there is an abund-

ance of water, especially if there is no tailing disposal problem, the answer comes from many a stamp-mill, from Gilpin county to the Mother Lode, from Ontario to Alaska, each with its own local inflection. Varying in equipment and practice; in stamps, mortars, screens, and plates; in drop, speed, feed-water, and plate-grade, as determined by local experience, yet essentially they are the same, and their deep chorus is retaining from 30 to 70% of the assay-value, including practically all of the coarse gold, in the mortars or on the apron plates.

I say practically "all of the coarse gold," for I do not believe that an appreciable portion of it can escape in a rusty condition from the mortars of a properly designed and operated battery. Such coarse gold as goes beyond the apron plates will almost inevitably be caught in the amalgam traps, on the vanners, or on other concentrators. If not, we are forced to the rather Celtic conclusion that it is not coarse gold.

Where water must be conserved, and, to some extent, even where the only difficulty is that the disposal of the tailing is restricted, the advice coming from the Black Hills, from the arid Southwest, and an ever increasing number of new districts is still to amalgamate for the coarse gold, but so long as the water must be separated, or recovered and pumped back, why not do the crushing in cyanide solution, for the cyanide is more efficient in the mortar than anywhere else.

Why does not South Africa join this chorus? That is another story. There the amalgamation recovery is so important that its efficiency must be the first consideration, and we must admit that a continuous feed of cyanide solution does not improve the character of amalgam or save mercury. Australia? Still another story, for here we have rebellious ore, much of it destined to roasting and grinding before final treatment. Really, when I started to answer the question it looked surprisingly elementary, but I find to cover it fully would really require a dissertation on the whole world's milling practice, so I shall have to let this suffice.

EDWIN C. HOLDEN.

New York, December 24.

Cyanidation in Nevada.

The Editor:

Sir—In your issue of Nov. 30, under the heading 'Cyanidation in Nevada,' R. Stuart Browne makes several statements in regard to the Goldfield ores, in which I think he is mistaken. In the first place Mr. Browne remarks that the ore is "a hard white quartz averaging about 85% silica, 7% pyrite, and about 8% lime, magnesia, etc." As a matter of fact, the ore is usually an altered and silicified dacite, with very little white quartz present. In the oxidized zone the silicification is especially strong, and the ore gradates from rock showing its original porphyritic structure to a dark brecciated quartz. In the sulphide zone the silicification is hardly so marked, but the ore is still essentially an altered dacite, in places changed to a dark flinty quartz, while in others the original structure of the rock is still plainly visible. Taking it as a whole, it forms a fairly hard tough rock, not easily reduced to a fine sand.

Mr. Browne also remarks that "tellurides of gold are frequently present." This is true only to a very limited extent. At the Mohawk, Great Bend, and several other mines, a little tellurium is present in the very high-grade ore, but in a great many cases the so-called telluride of gold is a form of tetrahedrite. Bismuthinite (bismuth sulphide) has also been mistaken for one of the telluride minerals in two or three cases. As a matter of fact, it is extremely doubtful whether any noticeable quantity of tellurium could be found in the ordinary low-grade ore of the camp of the grade mentioned by Mr. Browne (3 oz. gold). At the Combination mine during the three years that I was in charge of operations, a special look-out was kept for specimens of telluride minerals, but we were unable to find a single specimen in which the presence of tellurium was conclusively proved. I am, therefore, of the opinion that as far as the treatment of the milling grade of ore is concerned, with the possible exception of one or two of the mines in the Diamondfield area, the presence of tellurides need not be considered.

With such an ore as I have described, in which the gold is so finely disseminated, it seems to me very doubtful whether a good extraction could be obtained without comparatively fine grinding in addition to roasting. I am not sufficiently familiar with good roasting practice to form any idea of the probable cost of roasting Goldfield ores, but with coal at from $16 to $20 per ton, and crude oil at $2.70 per bbl. or thereabout, I am of the opinion that the cost of roasting the ore would exceed the additional cost of re-grinding to a finer state of division. During the seven months, from July 1, 1906, to February 1, 1907, the cost of re-grinding sand with a 4 by 16-ft. tube-mill of trunnion type, fitted with silex lining, was approximately 70 cents per ton of sand re-ground. This, I take it, is considerably less than the cost of roasting, with the best possible arrangement.

EDGAR A. COLLINS.

Tonopah, December 8.

Cyanide Practice at Copala.

The Editor:

Sir—In reply to the letter of Mr. D. G. Putnam in your issue of November 23, I would say:

(1) The methods of estimating cyanide and alkali mentioned in the article in question were not given by way of recommendation, but were intended to be merely explanatory, as indicating the basis on which the figures there given were obtained. It is taken for granted that every metallurgist will ascertain for himself the limitations of the methods he uses and their applicability to the individual conditions under which he works, because it seldom happens that any particular method of analysis is equally applicable under all circumstances.

(2) Mr. Putnam, in his letter, does not give the limitations of Green's ferro-cyanide method; he may see these by reading the paper published by Gerard Williams in the Journal of the Chemical, Metallurgical & Mining Society of South Africa for May 1904.

(3) Any suitable acid may be used in place of oxalic acid without affecting the procedure of the method in question. In cases, however, where too much solution is not made up at a time and where the acid burette is in constant use, oxalic will probably be found to maintain its standard as well as any other.

(4) Green has already pointed out the formation of zinc nitrate, acid to phenolphthalein; this nitrate, however, does not begin to form until the free cyanide has all been titrated and decomposition of the zinc-potassium cyanide commences, so that it would seem that Mr. Putnam's preliminary titration for free cyanide, in the instance detailed by him, was carried far beyond the real free-cyanide end-point, and probably to a point coincident with that which would have been indicated by the yellow end-point if using the potassium iodide indicator. The meaning of the term, 'first faint opalescence' seems to be the stumbling block. If Mr. Putnam wishes to know what we understand by it here let him first filter the solution to be tested for free cyanide until perfectly

clear and limpid, and place his measured quantity in a flask as transparently clean as the solution; then on adding the standard silver nitrate and observing the solution on a line with the eye against a dark background and with a good side-light, a faint general dulling of the brilliancy of the solution can be observed when the true free-cyanide has all been titrated. This is what we understand by the term, 'first faint opalescence.' Before this point is reached there may be sometimes a slight precipitate formed by the lime present, but this is easily distinguished with a little practice. If Mr. Putnam will test in this way to the true free-cyanide end-point and then add phenolphthalein and titrate with standard oxalic or sulphuric, or any other acid he may prefer, I think he will find that the protective alkalinity shown will agree closely with that indicated by Green's method.

I can assure Mr. Putnam that what he chooses to call the oxalic acid method does not necessarily "fail upon solutions which contain much K_2ZnCy_4" when properly performed, though I am not prepared to assert that it is universally applicable under different conditions; that is a point for each metallurgist to determine for himself.

L. N. B. BULLOCK.

Copala, Mexico, December 10.

[This is a good example of a useful discussion. Our readers will join us in thanking Messrs. Bullock and Putnam.—Editor.]

Capitalization of Rand Mines.

The Editor:

Sir—In your issue of December 21 my friend, Mr. Fischer Wilkinson, takes exception to my statement that, as a rule, the mines on the Rand are not over-capitalized, and says: "The nominal capital means very little."

It only means the thing that we are talking about, namely, the amount of capital placed upon a property by its sponsors and upon which the said property will pay adequate returns if the amount is not too great, that is, if it is not over-capitalized. He cites in refutation the price at which in many cases the working capital shares were subscribed, a point already alluded to in my first letter. But the working capital shares seldom exceed one-third and are sometimes less than that proportion of the total share capital, hence they are in the minority and cannot be regarded in any sense as the 'capitalization' of the company, unless the tail is to wag the dog. Their issuance at a premium is legitimate business, especially when guaranteed and underwritten by the issuing house, as already pointed out; in the cases cited an excellent return on the investment is being made even at the enhanced working capital price. For instance, in the case of the Witwatersrand Deep while the dividend is but 10% on the 80s. shares, it is 16% on the 50s. shares, or an average of 13%, quite good enough for a property with so long a life as it has. Moreover, this rate of dividends was established on monthly profits of £18,000 to £20,000, but the recent profits of £26,000 to £28,000 per month will admit of a decided increase in dividend over the 13% rate on working capital shares. The Robinson Central Deep, paying 17½% on working capital shares, is also good; hence admitting, for the sake of argument only, that the greater is to be measured in terms of the lesser, it is evident that the showing is still good. As for the Rand Mines Limited, comprising a group of 9 or 10 producing mines, and regarding which I am informed the dividend is to be increased, the 120% return may figure comparatively less on the *market* price, but that is a valuation which does not enter into the question of original capitalization in any manner, and was therefore purposely ignored by me.

With reference to the statistics quoted, these also I see are based on "market valuation of the shares," hence I fear they must be ruled out of order, with no necessity for quoting Disraeli on the subject of statistics. Finally, I must beg to submit, Mr. Editor, that your heading, 'Capitalization of Rand Mines' to my first letter, written in refutation of your editorial questioning the integrity of the Witwatersrand engineers, is something of a misnomer.

THOS. H. LEGGETT.

New York, December 31.

[The heading 'Capitalization of Rand Mines' seemed better than 'Integrity of Rand Engineers,' for the latter was a question that it was unpleasant and unprofitable to discuss further. Mr. Leggett holds that the engineers on the Rand are not responsible for any over-capitalization of mining companies and he denies that his professional acquaintances at Johannesburg participated in the flotations that made certain gentlemen at Hamburg and London so rich. We do not care to press the point. Mr. Leggett himself, Mr. H. H. Webb, and a few other first-rate men gave an example of professional decency, and it may be that they are generous enough to impute to others a standard as high as their own. Mr. Leggett says that he does not know of a single engineer who "gave his authority to over-capitalization and, indirectly, to the wild dealing in shares" during the boom of 1895 and at recurrent intervals. It may be that we are not agreed as to the definition of an engineer, and Mr. Leggett may refuse to recognize as fellow-professionals the men we had in mind. There never was a boom without such performances, and there never will be.—Editor.]

THE SAPPHIRE MINE IN MONTANA.—The sapphire mine at Yogo Gulch, Montana, is probably the greatest gem mine in the United States. The igneous dike which contains the sapphires has a length on the surface of about four miles; it probably descends to a great depth. It has been estimated that the entire content of workable sapphire-bearing rock may approximate 10,000,000 cu. yd. The stones obtained in mining this dike are not of large size. They range from 'culls' to gems averaging, when cut, from half a carat to two or three carats, and rarely five or six. The 'culls' are used for watch jewels and other mechanical purposes, for which they have an advantage over East Indian stones in their form; this is largely short prismatic or rhombohedral, with flat basal terminations. The gems are brilliant, free from flaws and range in color from light shades to the rich deep blue of oriental sapphires. They are sent to Amsterdam for cutting, and yield in finished stones from two-fifths to one-half of their original weight.

COPPER MINES OF ALASKA.—All the copper-producing mines of southeastern Alaska are on Prince of Wales island, in the Ketchikan district. The orebodies are genetically related to the intrusive rocks and occur either as contact or replacement deposits in the form of lenses or irregular masses. They are found in limestone, quartzite, or a greenstone-schist country rock. The chief copper ore is largely chalcopyrite, accompanied by pyrite, magnetite, and pyrrhotite, besides various gangue minerals. Enrichment zones are lacking, evidently on account of the absence of the zone of weathering which was removed during the glacial epoch; and at only one locality (Copper Mountain) are secondary ores present in quantity. At this place they extend only a few hundred feet below the surface.—Chas. W. Wright.

COLORADO.

Written for the MINING AND SCIENTIFIC PRESS
By FORBES RICKARD.

The end of 1907 finds Cripple Creek pre-eminent among the camps of this State, both in the record of production and in those steady improvements that give foundation for the production of the new year.

Cripple Creek production for the past year was close to $13,000,000. Dividends in excess of $2,000,000 have been paid out; in these the Portland, Vindicator, Mary McKinney, and El Paso mines have a good share of representation. The Cresson, South Dante, and Little Clara are among the mines that have come into recent prominence.

The drainage adit, still the most important piece of work affecting mining interests in common, got started in May on the 740 ft. of new 'backs' which it gets from the new portal. And while the advance has been delayed by the transfer of work from the hands of one contracting party to another, the adit has, mainly under the direction of the El Paso Co., been extended a distance of 1220 ft., out of a total of 26,000 ft. of this project. Driving is to be continued under new specifications.

The deeper development of several square miles of Cripple Creek's productive territory, to be accomplished through this adit, will coincide with a period in the history of the camp when milling and mining methods will have been brought near to the top notch of efficiency and improvement. It will bring within the range of profit and make available an immense area, much of which without such drainage would be out of reach of ordinary mining operations.

The end of this year sees the final stages of much litigation, which has been a hindrance to greater progress in the Cripple Creek district, notably the Portland and Stratton's Independence trespass suit. Signal advance has been made in the exploitation of the lower grades of ore from mines working under the lease system. The growth of the cyanide process, as shown by the erection of many new mills to treat the low-grade ores of mines and dumps, has contributed mainly to such a result. While the milling ore now ranges in value from $4 to $12 per ton, oxidized ores of an average value of $2.85 per ton have been successfully treated in the local mills. The successful exploiting of these low-grade ores must, in many instances, lead to discoveries of high-grade streaks, which under former mining conditions would have been overlooked. Particularly might that be the case where veins are blind and many of the dikes associated with the ore deposits do not come to the surface.

The Golden Cycle mill (750 tons daily capacity) of the company that bought the best part of the property of the United Gold Mines Co., was re-modeled, burned, and rebuilt during the year. After much adjusting of freight rates and treatment charges to meet varying competitive factors, the schedule shows an appreciable reduction in both transportation and metallurgical departments over the charges that have prevailed heretofore. Altogether, general conditions at Cripple Creek conspire toward the stimulating of the camp's production and an increasing activity in mine and mill.

While Cripple Creek has been receiving a stimulus from the advantage of the minting of its bullion production and meeting its payrolls with gold, Leadville has been operating under disadvantages of constantly falling metal prices and comes through the year with a showing that reflects the varied nature of its resources and does credit to the old camp. The slump in the prices of silver, lead, and spelter will for a time cut down the mining operations, through the closing of the Coronado and others of the mines in the down-town district, and some of the mines whose receipts and operating expenses have so near balanced as to make it a process of swapping dollars, yet Leadville has been equipped to make the most of the high zinc market that has prevailed through the greater part of the year and Lake county has been yielding 80% of the total zinc production of the State. During the year important discoveries have been reported from Leadville's gold belt, in the Breece Hill district. The Ibex group is employing from 400 to 500 men under lease and is getting high-grade ore from its 1300-ft. level.

The Yak Tunnel Co. has added to its already large development and has come through the year successfully. Its dividends will exceed the $320,000 mark of 1906. Of the production of the whole district, there has been heavy demand for silicious ores throughout the year. The monthly production has ranged from 71,000 to 77,000 tons, of which from 65 to 70% goes to the local smelters, from 8000 to 12,000 tons of zinc ore to outside points, and the balance to the Salida smelter. Among the newer enterprises that have come into prominence during 1907 are those of the Mammoth Co. in Big Evans gulch and the Bartlett Tunnel Co. on Sugar Loaf mountain. Rock Hill (in the Reindeer) has been the locus of new ore developments.

The mines of the San Juan have worked uninterruptedly and have maintained a good showing in 1907. In the Telluride district, a consolidation of small groups of mines was made through the Iona Gold Mining Co., and at Silverton a controlling interest in the stock of the Mountain Queen was reported sold to the Guggenheims. The Tomboy publishes the results of a most successful year.

In Gilpin and Clear Creek counties the progress of the Newhouse Tunnel claims first attention. It has this year drained the Saratoga and Old Town mines, through connections made with it, and incidentally disclosed new orebodies belonging to these properties. In March the adit had reached a length of 17,500 ft. and was then approaching the limit of its haulage capacity. The transfer and consolidation of the Six-Day and Perigo groups, near Rollinsville, was one of the interesting events of the year.

In metallurgical progress, two advances are noteworthy. The one is the introduction of the Huntington-Heberlein process in the Colorado plants of the American Smelting & Refining Co., making use of a partial roast preliminary to sintering before blast-furnace fusion. The object being to put the ore into condition admitting of lower temperature in the fusion; at the same time preventing lead loss and allowing of the utilization of a heavier proportion of sulphide in the smelting mixture. The other is the almost complete supercceding of the chlorination processes by cyanidation, and its accessory machinery and equipment, in the metallurgical practice applying to Cripple Creek ores.

In general, the mineral output of the State has been scarcely affected by the drop in the price of copper, since the production of this metal is, with small exception, accessory to the production of ores in which gold, silver, and lead predominate. The shortage of labor in the earlier part of the year did much more to limit the annual production than the lower metal prices of the last part of 1907. Cripple Creek especially experienced a drain upon its labor through circumstance of higher wages obtainable in the boom camps of Nevada. The exodus resulting has been checked in the latter months of the year and since the Goldfield troubles began there is promise of a gradual return of the Colorado miner to his former habitat.

Nagybanya, Hungary.

Written for the MINING AND SCIENTIFIC PRESS
By EDWARD SKEWES.

This district is in the eastern part of Hungary, bounded on the east by Roumania and Galicia. It is easily accessible, being about 13 hours railway journey from Budapest.

The principal mines are owned by the Hungarian Government, and the managers in charge may, in addition to their other titles, write Royal Hungarian Engineer. Some of these mines are very old. I was told that the Kereszthegyi, known hereafter as the Cross mine, had completed its one-thousandth birthday. On July 6 the Veresvizi, or the Red Water mine, celebrated its 500th birthday; all work in the mine was suspended, the mouth of the adit was gaily decorated with arches, evergreens, bunting, flags, and miners' lanterns; the interior of the machine-shop was like a conservatory. The Government distributed 2,500 litres of wine to the 540 employees.

The mines are among a series of hills related to the main range of the Balkans; they are situated at elevations varying from 400 to 800 metres. The country is well wooded, oak and birch being abundant. The formations are classed as trachyte and andesite, while the best mines are in quartz-trachyte, the eruptives breaking through the late Tertiary sedimentary rocks. The best mines are in a straight line from east to west, 20 km. in length, from Rota-Anna or Kapnik Banya to Nagybanya. Two kilometres farther west are the Borpatak mines, which have become famous within the last four years; the largest owner, formerly a Roumanian school-teacher, earning 18 kronen, or $3.50 per week, is now wealthy. Still farther west is Lapos Banya* which, prior to the fall in silver 20 years ago, was a hive of industry, as witnessed by several disused mills and smelters. In passing the site of an old copper smelter at this place I saw several men and women at work, and was told that they were milling all the slag, digging around all foundations, and milling the scraps for silver and gold.

The course of the veins is approximately north and south, usually five degrees more to the west of north than to the east of north; the dip may be both east and west in the same mine. At Felsobanya a good instance may be seen of the fan-like structure of the veins. The dip does not influence the productiveness of the veins.

The veins that I saw outside the main belt were narrow, none of them three feet wide, but were unmistakably veins continuous in length and depth, with well defined walls; they were as distinguishable as are the saddle reefs of Bendigo, there is no mistaking them. In several of the old narrow and crooked adits, I saw the results of using heat (of burning brush) to break the rock before the advent of explosives; such adits were unusually high and showed conchoidal fracture.

Through the courtesy of Mr. Bertalan I was permitted to go underground at the Cross mine. After walking 1,081 m. we came to a place where a large station had been cut, and where a vertical shaft had been sunk 380 m.; the bottom level had been driven at a depth of 332 m. At the station there are three large boilers, with electric hoists on both sides of the shaft; also large ore-bins, machine-shops, etc. The two drifts that I examined had been extended over 1,000 m. from the shaft, and the ventilation was good, save at the face, where it was unpleasantly warm for working, the men being almost naked, except for shoes and overalls, and in some cases even less. The veins are narrow when unproductive, but range from 2 to 5 m. in all the stopes, for where the veins are valuable they are always wide. The faces of levels were fully 2 m. wide. The cost of a drift on the vein, 2 m. wide and 2½ m. high, is 115 crowns* per metre; raises cost 80 crowns; and shafts 510 crowns. The vein is hard, principally quartz and sulphides. The height to the surface from the shaft was 300 metres.

The first 600 m. of the adit was built of, and arched with, stone, as were most of the levels where stoping was in progress. Instead of stull-timbers, old rails from 40 to 50 lb. were used, placed one metre apart, and covered with hard flagstone. From the ore-bins at the shaft to the mill the ore was conveyed in one-ton cars — long and narrow — hauled by one horse, drawing three cars, and pushing one car, by means of extended shaft, attached to the pushed car with an iron loop.

In 1896 a pamphlet was published giving a history of the mine; two or three extracts will be interesting. There is no record of the mine prior to 1086; in that year the Kuns (not the Huns) came and destroyed this mine with others in the district, and killed all the people in Nagybanya. In 1141 King Geiza II introduced the Saxons in large numbers to work the mine, and it was again in full blast. In 1490, while Columbus was dreaming of America, Prince Albert, a Polish prince, and brother of Ulaszlo II, the Hungarian king, burned the buildings, and work was abandoned. In 1710 the mine was again idle, on account of the miners suffering from an outbreak of boils and sores on the arms. About this time the Government officials resolved not to lease the mine, but to work it themselves, as it appears that every set of lessees left the mine in a pretty sickly condition. The tables from 1875 to 1895 are very full for every year. The figures are given in forints,† equal to 40 cents American.

TABLE I.

Year.	Income.	Expenses.	Net profit.	
	Forints.	Forints	Forints.	Dollars.
1875	232,396	176,722	55,674	22,269
1880	253,700	233,813	19,887	7,955
1885	301,783	185,414	116,369	46,547
1890	263,809	161,305	102,804	41,001
1895	285,913	177,941	107,972	43,191
1906	613,716	314,728	298,988	119,598

Another table shows full particulars of expense account, but only two or three items will be selected out of the 25 given.

TABLE II.

Year.	Tonnage.	Duty per stamp.		Concentrate.		Total value of ore.
		Kg.	Lb.	Tons.	¢	Forints.
1875	5,971	308	677	303	5.68	11
1880	7,160	323	700	349	4.87	10
1885	8,463	283	622	510	6.02	14
1890	8,224	332	730	645	7.85	16
1895	7,592	306	673	721	9.51	20

TABLE III.

Year.	Number of miners	All other employees.	Mill-ore.	Smelting ore.	Cost of stoping.	Office expenses, taxes, etc.	Total cost of stoping 1 cu. m.
			Tons.	Tons.	Forints.	Forints.	Forints.
1875	105	110	9,082	662	78.109	21.829	20.15
1880	76	189	8,590	1,126	46.341	24.423	17.23
1885	85	138	102	637	700.28	14.090	12.90
1890	83	132	94	361	594.95	17.859	15.66
1895	74	121	84	771	594.87	28.760	16.17

From Table II the duty per stamp (680 lb.) will appear ridiculously small, but the weight of the stamp is only 200 kg., the reasons for which will be given later.

The adit has a single track. Around the mouth of it there are no dumps; while the offices, machine-shops,

*Banya means mine; nagy means big; lapos, flat; felso, upper.

*A crown or krona is equal to 20 cents American.

†A forint is an old Hungarian coin, formerly equivalent to an English florin. It has not been coined since 1890.

magazines, warehouses, are near, all the waste rock must be conveyed some distance. The Cross mill was built close to the mouth of the adit. The building is long and narrow, and only one story. I have not seen a mill in Hungary built on a hillside. In the mill there are four sets of three batteries of Californian stamps, hand-fed, with no rock-breakers. In front of each set of batteries there are Rittinger (who was a Hungarian) amalgamators, about 2 ft. diam., which save from 6 to 8% of the valuable metals. No copper plates are used in the mills. The sand and slime are elevated by pumps to large spitzkasten, and the sand is concentrated on Rittinger tables, which were well regulated and were doing good work. The slime was treated on Bartsch revolving tables. (See Fig. 2.) From what I saw of the working of the Government mills, they appeared to be efficient, equal to the average of mills in other countries treating the same character of ore, containing galena, blende, antimony, iron pyrite, and quartz. The miners were expected to pick out the galena and blende when massive; this is sent to the smelters. The reason why the light stamps are used, is to prevent sliming; the principal portion of the gold and silver is in the galena and blende, and these minerals easily slime under a heavy blow and float on the water. An English company a few years ago, after spending 4,000,000 crowns in the erection of heavy stamps and up-to-date methods, was glad to sell its property for 350,000 kronen.

I omitted to mention that before entering the adit I was requested to put on a Government cap, a short coat with epaulets, brass buttons with hammer and pick embossed, similar to the crest of the A. I. M. E., also trousers, and there seemed to be a plentiful supply of such suits in stock for visitors.

The quartz trachyte in which this mine is situated is covered with andesitic tufa. There are many veins on the property. The reserves are estimated to last for 30 years at the present rate of production.

The Veresvizi, or Red Water mine, is named after the color of the water which flows from it. The present names of the claims which comprise this mine were given in 1764, and were not called after the discoverer's 'best girl,' as in the Western States, but were all named after the saints, as follows: St. Lipot, St. Josef, St. Haromsag, St. Marton, St. Ferenoz, St. Janos, etc. In 1775 the city of Nagybanya leased the mine to a private company until 1778, and in that year 472 lengths—as far as a man could stretch with his arms extended—were driven. The lessees, according to the records, did not keep up their development work. In 1795 the Government took possession and began to drive an adit. This adit is 11 km. long, with a height of 190 m. to surface. A shaft has been sunk 50 m. below. Fig. 1 shows the entrance of the adit. On this property there are 30 gold and silver-bearing veins, varying from 1 to 20 m. wide. The ore is in shoots, directly above each other, as shown in the sketch.

Through the kindness of Mr. Schmidt, the engineer of the Red Water, I accompanied him to an upper adit (Lobanya) which is 270 m. higher and 1 km. distant from the portal of the Svaiczer, or main adit. This adit must have been driven, at least part of its 800 m. in length, by the Romans many centuries ago. Here there was a waste heap, but a waste heap beautified by a variety of flowers growing in tastefully arranged beds, although in the midst of a large forest and a mile from civilization. In the adit there is a stope that serves as a vault or strong room; from it 150,000 or 200,000 crowns may be taken out at any time, if the mine requires it to meet any extra expenditure. It is not the Australian nest egg, in the shape of bullion, for the money is in the ore; the stope is 26 m. long, and from 1 to 5 m. wide. At one time 400 kg. yielded 13 kg. of gold. This ore is all sacked in the stope and the bags well sewn and passed from hand to hand to the adit. The vein was originally quartz, now it is rhodocrosite, with blende carrying silver and gold, next comes gray quartz with fine-grained galena, then a little calcite on the foot-wall, with small vugs or crevices in the richer portions. The miners employed in this stope are of the best selected brand, and are paid at the rate of 200 crowns, or $40, per month, together with a small percentage, from 3 to 4%, of the profits. There are two heavy iron gates in the adit. The miners work from 5 A. M. to 1 P. M., from 1 to 9 P. M., and from 9 to 5 A. M.

In connection with this mine there are three mills at work, all built on the level, and all using the same water as motive power and for milling, all lit by electricity, and in one, oil engines are at work. The mills are fairly close to the adit, the farthest not much more than a mile. The cars are of the same size and shape as at the Cross mine, and when drawn by horses four cars are moved; with locomotives, a train of 16 cars is pulled. The gauge is about 20 inches. This company has three locomotives. The horse-drivers used to stop at certain places and fill a small tank situated above the wheels on the side of the car; the water gradually fell on the rail through a small pipe.

In these mills the same methods are used as in the Cross mill. In the central plant a battery is employed exclusively for making tests. The smelting ore is also brought here, dumped from the sacks, and is crushed dry under Cornish stamps to the size of peas, sampled, re-sacked, and sent to the Government smelters. These three mills are well equipped with Californian and Cornish stamps, with Rittinger tables, concentrators, and slime-tables. They are well managed. The shipping ore carries about 130.80 in gold and 48 crowns in silver, or a total of $35.76 per ton. The mill-ore yields 21 crowns in gold and 1.30 crowns in silver, or about $4.50 per ton. The reserves in this mine are estimated at 22 years.

In the Felsobanya mill there are 75 stamps of 200 kg. each, and 72 wooden stamps weighing from 100 to 110 kg., and the mill treats from 30,000 to 33,000 tons per year. The cost of milling is 4 crowns (80 cents) and for mining, including all charges, from 8 to 12 crowns per ton.

Table No. IV shows the output, but in gold and silver only, together with the expenses of the Government mines in the Nagybanya district.

Table No. V gives the increase or decrease in the movable stocks during the year, also the profit and loss on the respective mines, together with the valuations; the last column is supposed to include everything that cannot be sold. These six mines are valued at 13,382,498 crowns, or $2,676,498; they made a profit of $75,518, or less than 3%. In ordinary mining, that is, with private funds, the interest would be considered low. The Hungarian Government mines, we are told, are not worked primarily for the profit, but for the benefit of the miners, and the towns near which the mines are situated.

Considerable improvement may be effected in the mines and mills owned by private companies or individuals. In one mine there were four persons employed pumping water by hand-pumps from a depth of 60 ft., in relays of about 12 to 18 ft., while there were only two miners at work stoping, but I have recently learned that there is to be a new management and that a steam-pump has been substituted. In connection with this mine there were nine stamps, 120 kg. each, which crushed three tons each per month.

The private mills, and there are many of them from Felsobanya to Nagybanya and from Nagybanya to Borpotak and from Umazzi to Lapos Banya, are very crude and primitive, all driven by water-power, with oak axles, cams, stems, and tappets (there are no rock breakers or feeders, even in the Government mills). The only machine is the Hungarian concentrator—a very remote ancestor to the bumping table of Gilpin county, Colorado,—which is a table 5 ft. wide, 9 ft. long, suspended by movable chains at each corner. The sides are six inches high. Motion is imparted by means of an extended arm under the head of the table, working in connection with a wooden axle and tappet, the blows varying from 1 to 3 per minute, and the distance of throw from 6 to 12 in. I saw over 60 of these at work, in more than a dozen different mills, but not one was being looked after as it seems to me it should have been. A small boy or girl fed the concentrator, and when the tailing end wanted raising a lever was put in a roller from which the end chains were hung and raised one notch. When the concentrator is full it is stopped, the tailing is thrown in the creek, the middling and heading to their respective departments for further treatment. The capacity would be less than 1½ tons per day.

This concentrator may have been suitable for the oxidized ores of 1,000 years ago, when the axle, cam, and tongue were new and in good order, but for the present ore it is not suitable, as it cannot possibly save more than 60%. In talking to the mill-owners, they said in effect —although I had to listen for hours: "My father worked the mine and mill in this way, and he handed it to me, and I must hand it over to my boy. We have not the money to erect new machines to save the slime, and if we did we should perhaps work too fast; we know we are losing 50% of the metals." In all the old mining leases the Government was entitled to all the mineral below 200 ft. in depth, consequently, for the sake of posterity, the mine must not be worked at express rate.

The free gold, here known as 'fire gold,' is extracted by a system of panning and then amalgamated. From a 20-stamp mill about 25 kg. of No. 1, or best concentrate, and about 35 kg. of the second concentrate, largely galena and iron pyrite, are sold monthly to the Government smelters. The pulp flows into strips, and the heading is carried to long narrow buddles having 45° incline; one boy attends to one buddle, and after feeding he cuts the block into small pieces with a wooden knife, so as to let the water pass uniformly. When the waste has been washed away a wooden trough is placed at the bottom of the buddle and the mineral is washed into it. These are panned and sometimes yield 'fire' or free gold. The toe of the pan is inclined on the principle of the vanning shovel. The pan is made of ¼-in maple wood, in some cases lined with tin; the sides and end rise 1½ inches. The operator, usually the manager or proprietor, takes the pan and strikes the back of it against a padded apron tied around his waist with a 3-in. throw, causing the heavy mineral to come to the back of the pan while the lighter particles are driven to the front, then a large bullock's horn, with a small hole at the small end, is held in the right hand and the lighter portion of the ore is washed into the tank; there is more shaking and more shaking, and more washing and more washing, until only a small portion of the richest is left; this is washed into a kettle, the contents of which are finally amalgamated. In the Government mill there were two horns for washing the pan; one had a very fine hole, used only during the final washing of the pan. In one large mill, where richer ore was being treated, there were four men constantly panning, with a responsible man supervising them.

The Hungarian cart is very primitive. It is drawn by two horses or oxen. The horses have but little head-gear. The body of the wagon has an inside measurement of 7 ft. 7 in. long, 1 ft. 9 in. wide, and 12 in. deep, say, one ton capacity. (Almost everything here is measured by dimensions, not by weight.) The body is secured to the carriage by means of a chain encompassing it in the centre, tightened by a long pole, the end of which is fastened to the rear. To unload is to unloosen the pole, remove the chain, and push the box over or shovel the ore out. For the carrying of concentrate a large basket with sloping sides and ends is placed on the four wheels, kept in position by upright poles connected to the axles by means of an iron loop, and lined with sacks. The wheels are 3 ft. diam. with 2-in. tires.

The Hungarian car was also crude, yet it meets the requirements of the narrow and crooked adits and levels better than the ordinary wheelbarrow. The width of the car is 10 in. There are no openings or doors, it must be lifted perpendicularly by the handles to be dumped. The central wheels are attached to the car by means of an iron strap. Both sets of wheels are underneath, the outside measurement being 6 in., so that they can easily be navigated over 8-in. plank by very small boys.

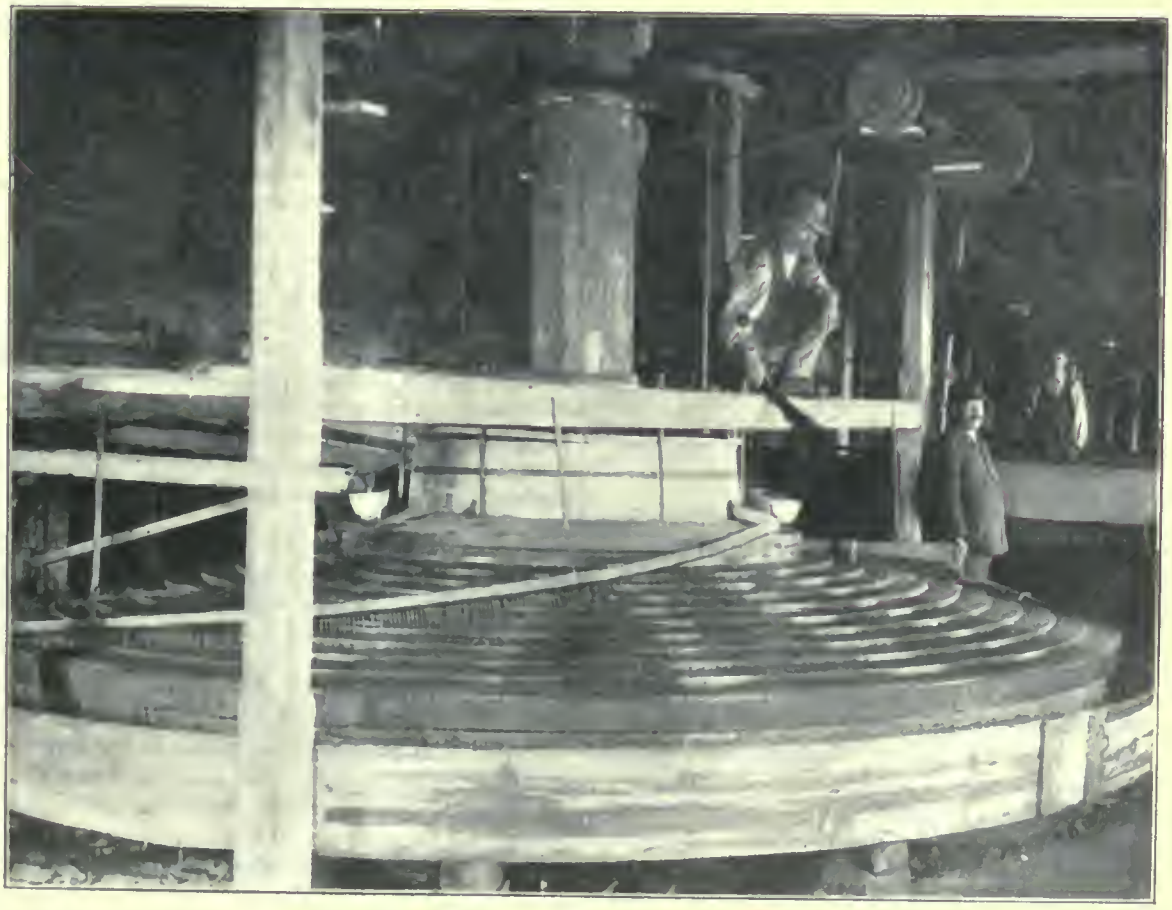
From what I saw of the Government officials at Nagybanya and Budapest, I feel confident that no foreigner need lose money without having a fighting chance, provided he consult the right men. I had occasion to compare some maps of mining leases with those of the Government records. The leases are in circles equal to 2,500 ft. diam., and these leases may be covered by a dozen other leases provided the centre of the prior lease is unmolested. The way the circles overlap each other resembles the overlapping of rectangular claims in a new mining camp in the West. In a private letter I wrote that "mining leases in Hungary are a delusion and a snare." The seller is usually careful to mark only his own circle on the map. A mining lease gives one the right to search for mineral in that particular lease. When mineral is found, the prospector takes a sample to the mining captain, the mining captain goes over the ground, compares the samples with the discovery, and if he thinks there is a 'mineral find' a notice is posted at the 'discovery point' to the effect that the prospector has applied for a 'mine' and that owners of adjoining circles must object or vacate all their rights in a rectangular block, 224 metres wide by 874 metres long, within a period of two months. This claim, when granted, is known as a 'mine,' and is unassailable while the yearly stipulated work is performed and the eight kronen are paid annually.

Geza Szellemy, the chief of the Government office of record, showed me a map where six circles covered the same territory. He also told me that in one case the Government received the eight crowns for the same area from nearly 20 different owners. I have since been informed that the owner or owners of a mine, by following their payable mineral under a lease, may apply for a mine to the exclusion of the owner or owners of the leases.

There are no private assay-offices, as Government laboratories are found in all the towns. The cost of assaying for silver is 70 hellers, about 15 cents, whereas if you want to know the gold in the silver, it costs eight additional crowns, or about $1.50. It did seem singular that a large sample could be pulverized, mixed with the necessary fluxes, scorified and cupelled for 15 cents, yet to part the gold and silver costs $1.50. The Government makes no reduction in price for a large number of samples, and the money must be paid beforehand; there are no exceptions to this rule.

Some of the younger members of the Department

Entrance to the Veresvizi Adit, in Hungary.



Interior of a Hungarian Mill, Showing Old-Fashioned Buddle.

would like to modernize the methods and make them more efficient; but in old countries there is a power with which you are unacquainted in the States, namely, Tradition, who will not die, neither can any David "hit him hard" in a vulnerable part.

Charcoal is used exclusively for fuel. Most of the labor in the assay department is skilled but not trained or technical. The Hungarians are quick to learn, and mix and handle the fluxes, scorifiers, and cupels well. The head of the Department does the weighing on the fine balances, and no more, save on special occasions. The Government will only purchase the ores or concentrates on scorifier assays, although they are low-grade, and the method is much more expensive than crucible assays, as large quantities of test lead are used in the former, which the Government must buy, whereas the Government makes its own litharge suitable for the latter method.

I took my samples to two different assay offices to check them, and the results agreed well. The assayers concede the fact that they are always low, and it is for a purpose, as the Government is a buyer. I took two of my check samples to Benedict Kitto, in London, and his results were 2% higher on 19 dwt. gold and 2 oz. silver.

At Fernezely there is a Government smelter which has been undergoing reformation for several months, so that several new reverberatory furnaces will be at work shortly. It was interesting in one of the old lead furnaces to see the Siberian hearth at work. The blast-furnace house, which is now idle, looks, with its 12 massive circular pillars on a side, like a nave of a cathedral. This house was built in 1853. Heap-roasting of matte is still carried on. Heretofore this furnace has had a capacity of 8,000 tons of concentrate per year.

A private company under the management of Henrick Auer, a well known chemist, is building a sulphuric acid works, the Government allowing the use of the sulphur from the smelter and giving a sum of money. Budapest and other towns will be available as markets. From Felsobanya station carloads of sulphur concentrate, also iron pyrite in lumps, are sent to Budapest to the sulphuric acid plants.

A prospectus, published in 1902, states that the wages of the miners is 1 crown per day; the wages today (apart from the Government mines) is about 50 cents per day, mechanics getting $1. The boys in the mines were earning from 10 to 15 cents and the boys and girls in the mills from three to five cents per day. The miners in the Government mines earn from 30 to 40 cents. These mines give steady employment, and a pension provided there has been good conduct. The only time there has been any labor trouble was during the spring of this year, when the miners in the Government mines asked for more wages, and I was informed the question was settled by a compromise after three weeks.

Beach wood for fuel costs 75 cents per cubic metre. No. 1 dynamite costs $7.50 per case of 50 lb., and detonators, $3.75 per 1,000.

The question arises: How does the management of the Government mines compare with that of the private properties? As a rule it is superior, but still one must confess that the standard of management of the former is not to be compared with the management of mines in the United States, Canada, or England. The private mines can call to their assistance the services of the Government engineers, through the Minister of Mines, without paying the consultation fees.

I think that Hungary holds out fair opportunities for successful mining in its gold and silver deposits, not to mention those containing zinc, copper, and antimony, besides the placers. The aid of the Government officials should be sought, and although they move slowly, they live. I have no doubt that a manager combining the enthusiasm of a "two year old" with the experience of a Methuselah, could galvanize the life of the department, and if so, success would be attained. The climate is good; the summer is hot; the winter is cold with plenty of sleighing. Labor is good, but saint-days are plentiful. I was told that in the Hungarian calendar there are 27 holidays, while in the Roumanian there are 37 days, all of which are religiously kept by the miners.

The ignorance of the language is not only a serious handicap but it is a tedious and vexatious worry, for it necessitates sitting or standing for an hour in order to ascertain through interpreters one simple question. A mining man, to do business here, should be able to talk Hungarian and Roumanian. All of the Government officials can converse in German.

AN ELECTRICAL HOISTING EQUIPMENT of considerable interest was recently built by the General Electric Co. for the Kendall Gold Mining Co., of Kendall, Mont. This equipment is designed to raise 2,000 lb. of ore from a depth of 1,000 ft. every 103 seconds when operating two drums, and every 170 seconds when only one drum is in operation. The shaft has two compartments and is vertical. Two cylindrical drums are used, provided with the usual clutches for individual and combined operation. The rope is 1 in. diam. and weighs 1.6 lb. per ft., the hoisting speed being 1,000 ft. per min. The feature of special interest about the equipment is one which was provided to overcome the effect on the somewhat limited generating plant from large rushes of current at starting, which tended to produce undesirable voltage fluctuations in the system. A fly-wheel, motor-generator set is provided, which consists of an induction motor and a direct-current generator with a heavy solid-cast fly-wheel swung between them, and a direct current exciter overhung at one end of the set. The system of control is arranged to brake the lode electrically in a manner which gives complete control over the retardation of the moving parts of the hoist, at the same time returning a considerable portion of their kinetic energy to the fly-wheel. The hoist equipment consists of a shunt-wound direct-current motor driving the drums by gearing, and receiving its power from the motor-generator set previously described. The small overhung exciter on the motor-generator shaft excites the fields of the direct-current generator and of the hoisting motor. The fly-wheel weighs about 12,000 lb. and operates at a peripheral speed of about 18,000 ft. per min. In order to obtain the value of the fly-wheel in alternately storing and surrendering energy, the induction motor is arranged for variable-speed operation, changes in speed being automatically controlled by the variation of the main-line current, which is led through a small three-phase regulating motor operating a water rheostat in series with the secondary winding of the motor.

MAN is the crowning work of God on earth, but though so nobly endowed, we must not forget that we are the lofty children of a race whose lowest forms lie prostrate within the water, having no higher aspirations than the desire for food; and we cannot understand the possible degredation and moral wretchedness ot Man, without knowing that his physical nature is rooted in all the material characteristics that belong to his type and link him even with the fish. The moral and intellectual gifts that distinguish him from them are his to use or to abuse; he may, if he will, abjure his better nature and be Vertebrate more than Man. He may sink as low as the lowest of his type, or he may rise to a spiritual height that will make that which distinguishes him from the rest far more the controlling element of his being than that which unites him with them.—Agassiz.

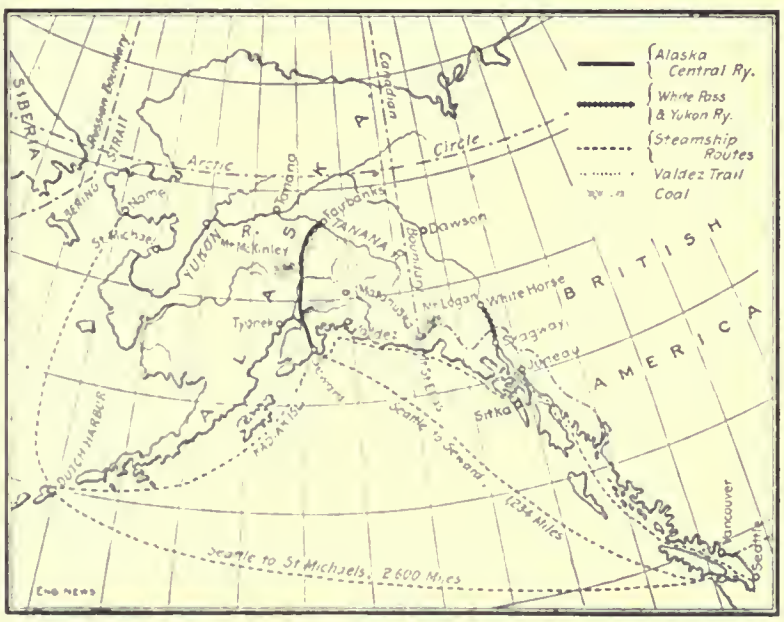
The Copper River District, Alaska.

Written for the MINING AND SCIENTIFIC PRESS
By W. M. BREWER.

I.—THE RAILROAD FIGHT.

At the present time the most direct route by which to reach this portion of the interior of Alaska is by way of Valdez, at the head of Prince William sound; thence 80 miles northerly along the Valdez and Fairbanks trail to Tonsina telegraph station where the Tonsina river (a tributary of the Copper) is crossed; and a short distance north from the bridge the traveler leaves the Government trail and branches off toward the east, following down the Tonsina river to near its mouth, a distance by trail about 25 miles; at this point the Copper river is crossed by means of a boat-ferry and swimming the horses, thence the trail continues in a general easterly course and crosses the following streams: Horse creek, Strelna, Kotsina, Kushkilina, and Lakina rivers. All of these, with the exception of Horse creek, empty into the Chitina river, which is itself a tributary of the main Copper river. The total distance from the Copper river to the crossing of the Lakina river is approximately 55 miles by the present trail, but this could be very much shortened.

As a matter of fact, while this mining district has been always designated as the Copper River district it would be much more appropriate to refer to it as the Chitina River district. Chitina really means 'copper river' in the Indian language; 'chit' standing for copper, and 'ina' for water or river. The Indians for generations have been finding specimens of native copper in and near the Chitina and its tributaries, while the stream known today as the Copper river lies to the westward of any known discoveries of copper ore.



Map of Alaska.

The discovery of copper in the mountains surrounding the headwaters of the Kotsina, Kushkilina, Lakina, and Chitina rivers was first made in 1899 by a party of prospectors known as the Hubbard-Elliott crowd. The discoveries made by members of this party are situated on a stream known as Elliott creek, a tributary of the Kotsina river, where a large number of claims were staked which today comprise a portion of the holdings of the Hubbard-Elliott Mining Co. This property is near the western boundary of the mineralized belt of this part of Alaska, and exploration has been carried on by prospectors to the east and northeast of these claims, although some property has been located adjacent to the Kotsina river itself.

During the past summer I made a hurried trip through a portion of this mining district, confining my examinations to the mountains adjacent to the headwaters of the Lakina. As far as the remainder of the district is concerned I visited none of the camps, but was enabled to form some opinion as to the problems confronting the operators of most of the properties lying between the Kotsina river and the Lakina, because the route followed by the trail has been laid out with a view to bringing the main trail in as close touch as possible with the various camps.

There is no question but that the most important problem to be solved in this part of Alaska is the question of transportation, and I deem that a brief discussion of the projected lines of railroad, and the difficulties attending construction, will not be out of place. For several years past the newspapers have made reference from time to time to railway building in this portion of Alaska, but it is impossible to judge of these matters except by making a personal investigation.

It was not long after the town of Valdez had been located at the head of Prince William sound (and Fort Liscum had been built about three miles distant from the town and on the opposite side of the bay) that John Rosene, then president of the Northwestern Steamship Co., conceived the idea of building a railroad from the vicinity of the town of Valdez into the interior by way of the Lowe river, Keystone canyon, and over the summit of the Coast range by one of the passes. He organized the Copper River & North Western Railroad Co. and made a futile attempt to move the town of Valdez to a site selected by himself about three miles down the bay, thereby expecting to seek relief from the ever present danger to life and property which has always menaced the town because of its situation in such close proximity to the foot of the Valdez glacier. Although he built a wharf and did considerable work on this proposed townsite, he was entirely unable to persuade any of the townspeople to move to his new site, and as a matter of fact no vessels ever landed there.

At about the same time Colonel Swanick, who had during the previous year been engaged in constructing a portion of the Alaska Central railroad from Seward at the head of Resurrection bay, came to Valdez and proposed to build from the old town into the interior by a route paralleling that selected by John Rosene for the Copper River & North Western Railroad.

This brings the history of railroad construction up to the season of 1905, during which year both of these companies did more or less work of a preliminary character, such as locating lines through Keystone canyon, with some grading, enough to cause a great deal of newspaper discussion; and in the fall of that year Mr. Rosene was successful in securing recognition from J. Pierpont Morgan, who proposed to continue the construction of the Copper River & North Western Railroad, in consideration of a contract with the owners of the Bonanza mine, which is near the head of the Chitina river. It was understood generally that at that time the Guggenheims had become heavily interested in the Bonanza property, and that the contract made by Mr. Morgan was between himself and the Guggenheims by which the railroad should have the contract to haul all the ore from that property for a term of years.

Previous to this, the town of Catalla, near the mouth of the Copper river, and some distance easterly from Cape Hinchinbrook, had been selected by Pittsburg capitalists, whose assistance had been secured by Dr. Bruner, as a desirable ocean terminus for a railroad into the interior of Alaska. This project, however, received but little consideration from men who knew the Coast, because Catalla is situated at a point where there are no harbor facilities and where the ocean swell breaks directly on the shore, and during several months in the year vessels can only discharge freight and passengers with great hazard and very considerable delay.

Early in 1906, M. J. Heney and associates actually commenced the work of railroad building, having selected the old Eyak cannery site on Cordova bay for their ocean terminus. At this point the harbor facilities are exceptionally good and afford safe shelter for vessels of any draught at all times of the year. Mr. Heney pursued a policy entirely at variance from that pursued by his competitors. He commenced railroad construction in earnest, instead of in the newspapers, which had been the rule previously followed by all his competitors, and by November, 1906, he had graded several miles of roadbed and had laid rails from the wharf at Eyak for a distance of some four or five miles.

Early in the summer of 1906, J. Pierpont Morgan's representative, M. K. Rodgers, arrived at Valdez to report on the situation instead of bringing in a big gang of laborers prepared to commence construction work on the John Rosene right-of-way. This gentleman, on investigation, not being satisfied with the condition of the surveys, sent parties of engineers into the field to run preliminary lines. He ascertained that a portion of the road would be on a 3½% grade if constructed from Valdez. Thereupon he set out to find a route with an easier grade, and in company with Captain Jarvis made a boat trip down the Copper river. They found that it was quite feasible to build a road on a water grade up the river and selected Catalla as their ocean terminus, securing at the same time enough land for terminal purposes.

The situation at this time was as follows: The Valdez route selected by John Rosene was turned down by Mr. Rodgers, representing J. Pierpont Morgan. On the Valdez route as selected by Colonel Swanick, some construction work was being performed, and about three miles of grading had been finished, besides a wharf and approach on which rails had been laid, the first spike having been driven by Judge Gunnison while he was in Valdez holding a term of the United States District Court. M. J. Heney was pushing construction on his line from Eyak or Cordova, as the place had been re-named. The Dr. Bruner outfit was doing some little work at Catalla on its terminal ground. M. K. Rodgers had made a report to his principals advising construction from Catalla because, while it was quite true that considerable expense would be involved in constructing such substantial breakwaters as would insure good harbor facilities, yet the road when constructed would be on the east side of Copper river, thus avoiding some very expensive bridge work which would be necessary in the case of the Heney route, as the railroad on that line would approach the Copper river from the west side.

The engineers who located the line for Mr. Heney report an average grade of ½% from Cordova to the district in which the copper mines east of the Copper river are situated, and that while the bridge work necessary to cross the Copper river would be expensive, yet it is quite within their power to erect such a bridge as will be perfectly safe and secure.

During the winter of 1906 and 1907, J. Pierpont Morgan and his associates bought out the Heney project in its entirety, thus removing the most dangerous of all the competitors from the field. Mr. Rodgers, who was managing for Mr. Morgan on the Pacific Coast, did not contradict any newspaper reports to the effect that not only would the Heney route from Cordova be abandoned but that the rails already laid would be taken up and all the movable equipment taken to Catalla. On the opening of the season of 1907 active work was commenced by Mr. Rodgers and the Dr. Bruner party at Catalla, while all the other projected routes were, so far as could be judged from the conditions, abandoned. One advantage in building from Catalla, provided there were good harbor facilities, was that the distance from that point to the coalfields is only about 20 miles, while from Cordova to the coalfields over the route selected by Mr. Heney is about 70 miles.

Soon after the two opposing forces had commenced work at Catalla, in the late spring of 1907, friction occurred because of the attempt of the Morgan workmen to cross the right-of-way of the Bruner railroad. In this the Morgan party was successful after a skirmish in which the opposing forces used clubs, axes, and pick-handles for weapons. This followed an ineffectual attempt on the part of Dr. Bruner's men to obtain an injunction from the court at Juneau restraining the Morgan outfit from securing the crossing.

During the summer and autumn of this year the loss from wrecked lighters and because of the delay occasioned through holding vessels in the roadstead to await favorable opportunities to discharge their cargoes has been enormous, so great indeed that recently Mr. Morgan and his associates made a contract with Mr. Heney to return to Cordova and construct the railroad according to his original location. It is reported, however, that this company intends to continue building the line from Catalla to the coalfields and from there to the point where it will form a junction with the Heney road building up Copper river. In the meantime it is reported that the Dr. Bruner party is also continuing building operations toward the coalfields.

During the month of August Mr. Reynolds, the president of the Alaska Development Co., created quite a boom in Valdez by proposing to take over the Colonel Swanick project and build that road to the summit beyond Keystone canyon, making the promise that he would have it in operation in time to haul freight out from Valdez during the coming winter. When his surveyors started to run lines through Keystone canyon the Copper River & North Western Railroad Co., or Mr. Morgan's party, immediately discovered that the old John Rosene route from Valdez had not been abandoned and an attempt was made to stop Reynold's surveyors from continuing their work. This attempt was so forcible that several men were wounded by shots fired at Reynolds' men, who are reported to have been unarmed. Later, the Reynolds project fell through because of his inability to finance it, and several hundred laborers were landed in Valdez unable to secure their pay, thereby causing considerable consternation among the people of that town, who for a time apprehended that rioting might result.

Judging from the past actions of the Morgan party, an outsider can only conclude that they have determined to control southwestern Alaska.

ALLUVIAL DEPOSITS in Japan are represented by alluvial gold in the district of Esashi, in Hokkaido, and iron sand in Chugoku. The former is derived from auriferous quartz veins in the Paleozoic rocks and deposited in the river-beds.

Leasing the Federal Coal Lands.

Written for the MINING AND SCIENTIFIC PRESS
By H. FOSTER BAIN.

Whether the remaining coal lands belonging to the United States shall be sold or held for development under a leasing system is a question likely to come sharply to the front at Washington this winter. The President has recommended a leasing system. He has in view seemingly the better safeguarding of our future by conserving our mineral resources and feels that the public as a whole is more trustworthy than are individual owners. It may not be unprofitable to consider briefly what may be urged for and against the proposed leasing system.

In the first place it is to be remembered that the American system of allowing mineral lands to pass into the hands of individuals without recourse is unusual. In many countries the leasing system now obtains and in the United States it was in operation in the Upper Mississippi valley lead district for many years. In certain cases, in lieu of lease rentals, special taxes are assessed against mines and mining. In the United States such special taxes are not common and in general mining property is considered as only taxable on the basis of any other property; though the method of assessing and collecting the tax may be special, as it is in the case of railways and indeed, other kinds of property.

The change from the early system of leases to the present one of individual ownership was brought about mainly by the desire to promote the rapid development of the country and to afford the largest possible scope for development of individual initiative. The Government has never been run as a money-making business and the ownership of land, mineral or otherwise, has never been looked upon from that point of view. Land of all kinds has been sold or given away with practically no thought of its present or future value, but with the expectation that this would not only give our citizens the best chance for their own development but would also develop taxable wealth far greater than the value of the land itself. There can be no question that in the past this policy has justified itself and our gain in material wealth and in the quality of our citizenship, measured only as wealth-producers, has been worth many times any reasonable value that might have been placed on the land. There may nevertheless be reasons why a policy good in the past should now give place to one better for the future.

Considering the matter first as a business proposition, there can be no question that if we as individuals owned the coal lands and did not need the money represented by that ownership, we would not sell them at the present price or at any reasonable multiple of it. The revenue derived from the sale of mineral lands is so small as to be negligible and the Government, because of its greater credit, could if need be, borrow money to carry the lands at a lower rate of interest than could any individuals or corporation. As a business proposition then we need not hesitate to do collectively what we would do individually. The land will never sell for less money than now. Furthermore when the coal is mined in the years to come, the interest charge against the investment will be smaller if the Government carries the land than if it be disposed of to private parties. Under these conditions, the possible selling price will be lower. It goes without saying that a low selling price for fuel is a matter not only of individual interest but of prime importance to our very civilization.

In the second place, the separation of mineral title from surface title and the disposal of the latter would open the way to the settlement of certain lands available for dry farming which though underlain by coal are not of such immediate value to the farmer as to warrant his paying a coal price for his land. It is certainly reasonable that each piece of land should be made available as rapidly as possible and if the presence of coal is going to keep land out of cultivation which might be farmed, a change is desirable.

It will probably be conceded by everyone familiar with the conditions that the present mineral land laws, and particularly the coal land laws, need thorough revision whether we go to the lease basis or follow the present plan of selling the land. It has been abundantly shown that the present laws do not permit of the honest acquirement of tracts of coal land in sufficient area to meet modern conditions of development. Indeed they were not designed to do so. They were planned on the basis of individual development of small mines and were a part of the general policy of helping the individual to land-ownership. The very fact that they do not now do this is in itself a strong argument against the continuance of the system. If the sale of coal lands does not meet this prime condition of helping the establishment of individual citizens on an independent basis, it fails in its most important mission. One needs only to read the testimony in the various land fraud cases recently tried, to realize that the laws as now existing are of benefit principally to unscrupulous speculators and open the way to debauching citizens at the same time that they unfairly penalize corporations and individuals honestly trying to develop the coal-mining industry.

Modern conditions demand that large tracts of coal land should be given for development and mining into the hands of single companies. Are we prepared to give this land irrevocably to them by sale, or is it better to lease for a term of years under such terms and conditions as may be fair to all interests? A few years ago it was the custom to give perpetual franchises for street railways, public water systems, and other public utilities. It is now generally recognized that this is both unwise and unnecessary. Capital is found for all these enterprises upon the basis of franchises extending from 20 to 50 years, and as the various franchises expire new ones are drawn upon terms that better meet the conditions. No one can foretell for 50 years what will be wisest as regards conditions of coal mining. Why then bind ourselves for eternity? Is not coal a prime necessity, just as water and local transportation are? There is no injustice in this plan since a mining plant works itself out within the limits of such a term of years, and a new plant is necessary in any event. All coal mining is done on the basis of amortization of plant and land investment, and if a royalty be paid in place of interest and sinking fund charges, the financial transaction is the same. This royalty need not be burdensome. The President has stated that from his point of view the matter of revenue is not important. The royalty may be made as low as is necessary to get the best results. This is probably the right attitude, though it may be pointed out that leasing is nothing new in the coal industry, and everywhere there are mines working on royalties side by side with others which have all interest charge on land investment much lower than the royalty. While coal is now mined and sold on a relatively narrow margin, any ordinary royalty is a very small element in the cost of the coal, and a royalty which would make the administration of the coal lands entirely self-sustaining would be no burden to mines working on government land.

What then would be the advantage of the leasing system? The principal advantage would be that it would leave the way open at the termination of any existing lease

for a readjustment of conditions. When the land is sold the Government has no further control of it and must rely upon indirect uses of its power of taxation for any regulation which changed conditions may make necessary. Taxation should be on its own basis and not distorted to serve other uses. Aside from the power of taxation, Federal and State, there remains the police power of the State. This extends only to matters of safety and affords no means of controlling the conditions of mining as relates to waste. The latter may be written into the terms of a lease with the single reservation that the terms may not be made so onerous as to leave no profit. In that event no one will be found to take up the lease.

It goes without saying that leases will need to be carefully drawn, but being in the nature of bargains the combined experience of the coal operator and the government expert would be brought to bear on them. In the leases, so long as leased mines were in competition with mines on private lands, many concessions would need to be made to the operator. All this could, however, be done without in any way altering the fact that a re-adjustment would always be possible at the termination of one lease and the granting of another and that this is not possible when the land is once sold.

The practical difficulties in introducing a leasing system in the coal business are probably less than in the case of any mining industry, save possibly oil. Coal-mine operators are already thoroughly familiar with the leasing system. It is true that the movement has recently been away from leasing and toward ownership but there are special reasons for this.

It goes without saying that if the coal lands in the various Western States are to remain Government property and hence for all time exempt from State and local taxation, some compensation, such as a division of royalty, should be introduced. It also seems clear that if this system is introduced it will care for high administrative talent and officers thoroughly familiar with coal mining. This is an added reason for the establishment of a Mining Service or Bureau of Mines as has been recommended by the President and is now under consideration at Washington.

Summarizing the reasons for the introduction of a Federal coal-land leasing system, they are:

(1) The failure of the present coal-land laws, designed to meet the conditions of small ownership, to measure up to modern needs and the resulting necessity of a thorough revision.

(2) The necessity, if the sale plan be continued, of selling large tracts of valuable coal-lands to individual corporations. It is at least doubtful whether public opinion will now permit of this.

(3) The higher ultimate cost of the coal if the reserves are to be carried at private rather than at public charge.

(4) The possibility under a leasing system of revision of terms from time to time to meet new industrial conditions.

(5) The possibility from time to time of providing for less wasteful development and better conditions as regards safety of men and property.

(6) The reserving to future generations of some control over one of the prime necessities of our civilization.

DURING the last 50 years of mining in Great Britain the yearly number of fatal accidents has not varied very much, keeping around an average of 1100 accidents per year. In this time the number of miners employed has increased steadily from 200,000 in 1851 to over a million in 1906 so that the percentage of fatal accidents has greatly diminished.

The Prospector.

Enquiries sent to this department are answered free of charge, if submitted by subscribers who are not in arrears. The full name and post-office address of the sender must be given, otherwise no answer will be made. Those who are not subscribers must accompany their questions with a fee of $3 for each question. No assays are made.

I. C. L., of Nevada City, sends Basalt.

J. F. P., of Fairview, Nev., sends a specimen of Rhyolite.

M. L. M., of San Juan, Porto Rico, sends altered Andesite.

Quartz containing Graphite was received from W. H. W., of Amalie.

J. C. S., of Jerome, Ariz., sends a specimen of Chlorite-Mica Schist.

Specimens from Nogales, Sonora, are: No. 1, Trachyte; No. 2, Rhyolite.

The samples from Rawhide appear to be altered volcanic Breccia.

The rock from Clinton, S. C., marked X. Y. Z., contains Arsenopyrite.

Gypsum and Carbonaceous clay were sent by B. G. R., of Taos, New Mexico.

The specimen sent by J. P., of Eureka, Nev., is plumose Pyrolusite in quartz.

The specimens from Soulsbyville marked J. L., are: No. 1, Schist; No. 2, volcanic Tuff.

A specimen of mineralized Diorite was received from T. McD., of French Gulch, California.

The rocks from R. N. B., of Boise, Idaho, are: No. 1, Basalt; No. 2, Andesite; No. 3 and 4, Trachyte or Andesite.

J. C. H., of New York, sends specimen containing a quartzitic vein carrying Pyrite and stained red by the oxide of iron.

The specimens from Ventrigger, Cal., marked M. J. S., are: No. 1 and 3, decomposed granitic rock; No. 2, brown Calcite.

The brilliant yellowish-red mineral from Tucson, Ariz., is Vanadinite, the vanadate of lead. Associated with it is Descloizite, another lead vanadate.

The specimens from Nelson, Nev., marked F. E. A., are: No. 1, Biotite-Andesite; No. 2, Andesite; No. 3, Granite; No. 4, Quartzite; No. 5, Quartzite; No. 6, Chert.

W. L. B., of Greenville, Cal., sends: No. 1, Rhyolite; No. 2, Quartz-Porphyry; No. 3, Porphyrite; No. 4, Diabase; No. 5, Porphyrite; No. 6, Bornite and Chalcopyrite; No. 7, Chromite; No. 8 and 9, Serpentine.

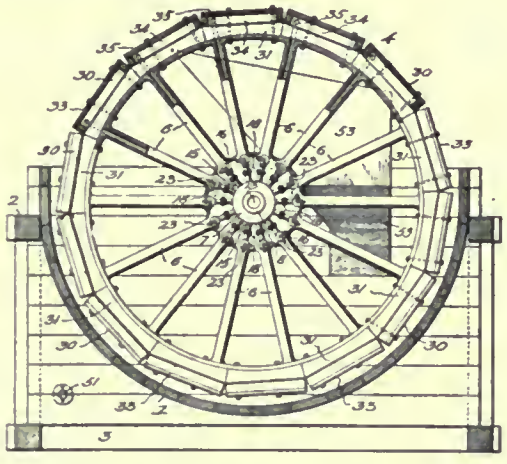
M. J. S., of Palomas, Ariz., sends: No. 1, Cuprite, Malachite, and Quartz; No. 2, black Limestone and Quartz; No. 3, Hornblende; No. 4, specular Hematite; No. 5, specular and red Hematite; No. 6, specular Hematite in rock.

The specimens from Wonder, Nev., marked H. G. G., are: No. 20, Rhyolite; No. 21, Nevadite; No. 22, Diabase; No. 23, Breccia; No. 24, altered Rhyolite; No. 25, Rhyolite-Breccia; No. 26, altered Rhyolite; No. 27, altered Rhyolite; No. 28, Diabase.

MINING AND METALLURGICAL PATENTS.

Specially Reported for the MINING AND SCIENTIFIC PRESS.

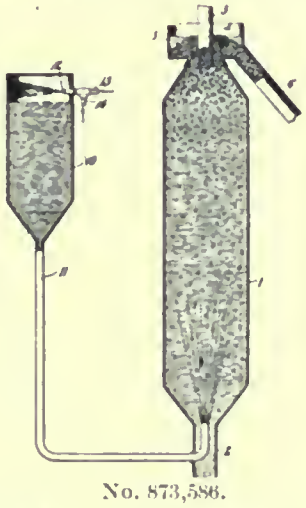
REVOLVING FILTER.—No. 872,616; Oscar H. Fairchild, Denver, Colo., assignor of two-thirds to William Archer Diboll, Denver, Colorado.



A revoluble filter, comprising a semi-circular solution tank; a wheel mounted in said tank so as to be partially submerged, and having passages which connect on one side with a vacuum tank and on the other side with a source of fluid under pressure; filter boxes on said wheel communicating with said passages, and automatically operated valves for controlling said passages.

HYDRAULIC SIZING-MACHINE.—No. 872,620; Louis C. Graupner, San Francisco, California.

No. 872,620.



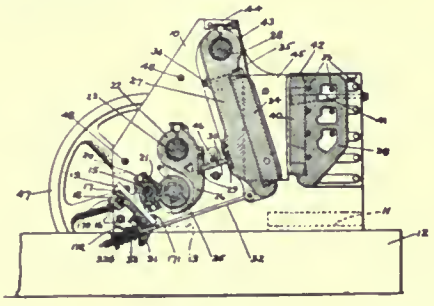
No. 873,586.

In a sizing and separating apparatus, the combination of a settling receptacle, said receptacle having a wall adapted to connect with the interior of a grinder, an overflow valve connected with the upper part of the receptacle through which pulp held in suspension in the upper part of said receptacle may be classified and delivered, said wall comprising adjustable gates arranged in overlapping order and having channels connecting with the interior of the receptacle, and an oversize valve in the lower part of the receptacle, said receptacle having a return port for returning the coarser material to the grinder.

APPARATUS FOR SEPARATING THE METALLIC PARTICLES OF ORES FROM THE ROCKY CONSTITUENTS THEREOF.—No. 873,586; Dudley H. Norris, New York, New York.

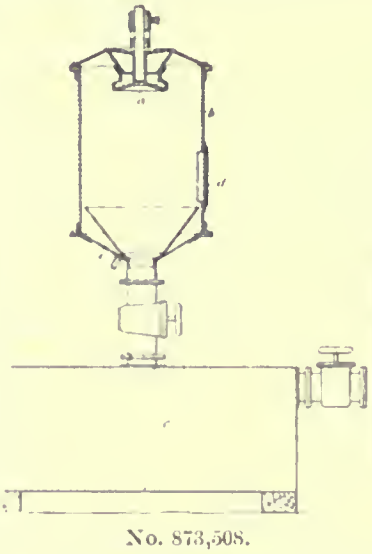
An apparatus of the character described, comprising a receptacle having its upper end open to the atmosphere and adapted to receive a flowing mixture of pulverized ore and water, means for introducing a stream of water containing air in solution into the mixture in said receptacle to cause infinitesimally small nascent bubbles of air to form in said mixture and rise to the surface thereof to collect the metallic particles of the ore together, a member arranged at the upper end of said receptacle to receive the metallic particles of the ore, and a discharge pipe at the lower end of the receptacle out of which the water and the rocky particles of the ore pass; substantially as described.

MULTIPLE ROCK-CRUSHER. No. 873,080; Edwin S. Philips, Kennett Square, Pa., assignor to The American Road Machine Company, Kennett Square, Pa., a Corporation of Pennsylvania.

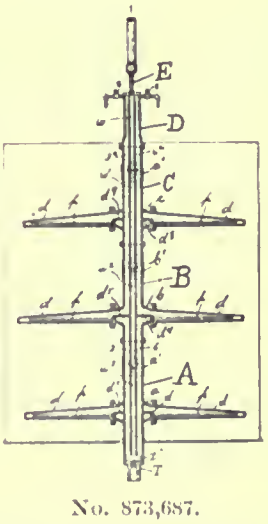


In a rock crusher, the combination with the side plates, of a shaft between the side plates and a plurality of moving jaws swinging thereon, a second shaft between the side plates back of and below the first shaft, and a plurality of tumbler-levers, corresponding in number to the moving jaws, swinging thereon and actuating the moving jaws respectively, a main cam shaft between the side plates back of and below the second shaft, cams fixed thereon corresponding in number to the moving jaws and actuating the tumbler-levers respectively, a cross-brace between the side plates back of the main shaft, and brackets on the cross-brace having bearings for the main shaft extending between adjacent cams, substantially as described.

ELECTRODEPOSITION OF COPPER AND OTHER METALS.—No. 873,508; Sherard O. Cowper-Coles, London, England.



No. 873,508.



No. 873,687.

In the electrodeposition of metals from solutions which have to be maintained in an oxidized state, the process of freeing the solution from impurities in suspension, which consists in passing the same through an atomizer and bringing it into intimate contact with air so as to convert and maintain it in an oxidized state, substantially as described.

ROASTING-FURNACE SHAFT.—No. 873,687; Grant B. Shipley, Milwaukee, Wis., assignor to Allis-Chalmers Company, Milwaukee, Wis., a Corporation of New Jersey.

A stirring shaft provided with a plurality of hollow arms, said shaft being also provided with passageways communicating with the interiors of said hollow arms for supplying a cooling medium thereto and with passageways communicating with the interiors of said arms for the discharge of the cooling medium therefrom, a separate discharge passageway being provided for each arm, said passageways of said shaft being adapted to convey the cooling medium in contact with said shaft to cool the same.

The Outlook for Copper.

Written for the MINING AND SCIENTIFIC PRESS
By MISHA E. APPELBAUM.*

The year 1907 proved as sensational in the copper industry as it did in the general world of finance. Against the most flourishing conditions existing at the beginning of the year a demoralized state of affairs prevailed in October and November, and it was not until a week or so before the present writing that the copper market showed a resumption of activity and hopes were felt for a substantial, though gradual, improvement.

At the end of 1906 it was the general opinion that the stocks of copper were very small and that a good business would result during at least the first half of 1907. Copper continued to advance from the closing price of 24 cents until a level of about 26 for lake and electrolytic brands had been established. The subsequent history of the market for 1907 is a simple one. During the first half of the year a good business was done in copper; then the American consumers withdrew from the market, and a general business depression having already made itself felt, they were not tempted by even the heavy reductions in official prices and thus the market declined to 25¼, to 22, then to 18, 15, and 13½, and finally sold in October as low as 12 cents. Just at the height of the financial panic a little spurt occurred in copper and this carried the price up to 15 cents, but with the approaching holidays, during which most of the American consumers closed their mills for a week or 10 days for the purpose of taking inventory, and their refusal to make commitments before money became easier and a revival of confidence took place, copper again sagged down to 13 cents. Though the official quotation was 12¾ to 13 cents it was practically impossible to obtain copper at that price, and some of the American consumers having large orders under 13 cents and being unable to obtain the metal became rather nervous and increased their limits, with the result that on December 21 the only copper obtainable was for December and January delivery at 13⅜ and 13⅝ for February. Beyond that it was practically impossible to obtain copper at around these prices.

A good many criticisms have been directed against one of the leading selling companies for the manner in which prices were held and broken, but it should be remembered that no one foresaw the panic and therefore it is my opinion that the decline in copper has also been one that no one could foresee. There is also a good deal of talk as to the amount of copper stocks in Europe and on this side. I do not think that in view of what has happened in copper it is possible for anyone to estimate even within 25,000,000 to 50,000,000 lb. of the actual stocks on hand. The only public figures deserving of credit are those quoted by the *Boston News Bureau* of December 13, in an interview with John Gillie, general superintendent of the Amalgamated properties. He reports an accumulation in October of 300,000,000 and sales of 161,000,000 lb., so that one naturally concludes that there are 139,000,000 lb. of copper still unsold; and one must also consider his remark that some of the sales have been made into February, so that perhaps the actual stock on hand is between 150,000,000 and 160,000,000 pounds.

With so many mines already shut down and only a fair business doing in copper, it is my belief that the surplus will shortly be wiped out and that unless the mines are opened a sharp squeeze will result. And since at the present moment most of the large mines can produce copper with profit and pay good dividends on a 14 to 15 cent market, it is to be hoped that when the price gets to that level the mines will open and a conservative and steady level be established, enabling both the consumer and the producer to do business at mutually advantageous prices. At a 14 to 15 cent level the production would continue at a satisfactory rate and the consumption would certainly not be restricted. Of course, a good deal depends on the financial and business condition of the country and if we have seen the worst and the expected improvement comes, we shall see a good business in copper.

*President of the New York Metal Selling Co.

Commercial Paragraphs.

THE FULTON IRON WORKS wish to inform their friends and the trade in general that F. H. Johnson is *not* connected with their company.

THE BOX ELECTRIC DRILL CO., of 115 Broadway, New York, issues Bulletin No. 201, describing the special drill manufactured by them.

THE WESTINGHOUSE MACHINE CO., of Pittsburg, have manufactured storage batteries for a number of years, but they have just issued the initial catalogue on the subject, entitled 'Westinghouse Storage Battery for Portable Use.'

THE KROGH MANUFACTURING CO. announces the completion of a three-stage 300-ft. head Krogh centrifugal pump direct-connected to a general electric 220-volt A. C. motor for the Channel Mining Co., at San Andreas, Cal. This pump will replace one four-stage and one three-stage pump of other designs now being used to unwater the mine.

L. S. PIERCE, of 1650 Champa St., Denver, recently shipped one 50-ton Pierce Amalgamator to the Atlas M. & M. Co. at Ouray, Colo.; one 12 by 24-in. machine to Johannesburg, South Africa, through the Export Shipping Co., of New York; and two 40-ton machines to Baily & Clark, at Portland, Oregon. Catalogue No. 10, which describes the machine fully, is ready for distribution and will be mailed upon request.

THE MEXICAN MINES-PROSPECTS DEVELOPMENT CO. has been organized in Mexico City for exploration, prospecting, development, and the operation of mining properties in various districts of the Republic. The board of directors comprises W. Landa y Escandon, J. L. Requena of the Dos Estrellas mine; A. G. Mills, of the Otis Elevator Co., M. G. Harner, and P. A. Babb, the last named being the company's manager and consulting engineer. The company already has several properties, which are to be developed.

THE ALLIS-CHALMERS CO. describe the Tremain steam-stamp in their bulletin No. 1408. This stamp has been designed especially to meet the demands of those who own mining properties in the first stages of development; enabling them to establish a thoroughly good crushing, amalgamating, or concentrating plant of moderate capacity in the shortest possible time, with the least material, and for the least money. This machine has not only proven itself highly successful for this purpose, but has shown an economy in all matters pertaining to its operation which is remarkable, and which compares very favorably with results obtained in works of larger capacity; the original plant can be readily and advantageously augmented from time to time as the development of the mine progresses, by the addition of more machinery, at a cost a little more than that of the machines themselves. The Tremain steam-stamp requires no engine, shafting, pulleys, belting, gears, cams, or tappets. Not being dependent on cams for raising or gravity in dropping, the speed and capacity per stamp-mill is, therefore, more than doubled. Owing to the compact construction, it can easily be carried on mule-back over mountainous roads.

Catalogues Received.

THE CLING-SURFACE CO., of Buffalo, N. Y., has issued a catalogue entitled 'The Treatment of Belts and Ropes for Service and Profit.' In addition to describing the company's manufacture, 'Cling-Surface,' the catalogue gives much useful information about the proper treatment for belts and ropes under the various vicissitudes to which they are subjected.

THE B. F. STURTEVANT CO., of Hyde Park, Mass., have issued 'Bulletin No. 151, Steam Turbines.' This describes and illustrates the steam turbines manufactured by it; these are of the impulse type, in the sizes below 200 hp., single stage, in the larger sizes two to four stage. The bucket-wheel is a single forging of best open-hearth steel. One of these turbines is in use at Bridgeport, Conn., where it is giving satisfactory service.

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Editorial.

THE TRANSVAAL mines ended the year with a record output of 583,525 ounces of gold for the month of December, making the total yield for the year no less than 6,451,383 ounces, worth $133,350,086, which is a gain of $14,137,149 as compared to 1906.

CALIFORNIA is rich in minerals and has been the place of origin of many new mineral species. No one is better fitted to write on the subject than Mr. Arthur S. Eakle, professor of mineralogy in the State University, and many of our readers will find it interesting to note the array of minerals that were first found within the boundaries of a region so rich in natural resources.

IT APPEARS that a dispute as to the ownership of ore near the boundary separating the La Rose and Right of Way mines at Cobalt was settled by a commission of engineers, consisting of Messrs. R. Askwith, R. W. Brock, A. A. Cole, J. B. Tyrrell, and A. Wilson. They examined and sampled the workings, and their decision has been accepted by the parties concerned. This is a precedent worthy of imitation.

ACCORDING TO the statistics of the New York Stock Exchange, the combined sales of 12 active issues totaled 142,698,873 shares, or 73% of all the business transacted. In the case of 11 issues the number of shares traded exceeds the total stock, and in the case of Reading, American Smelting, and Union Pacific, the whole of the outstanding common shares of these companies changed hands from 17 to 20 times during the past year. This is pretty good proof that gambling, not investment, dominates the activities of Wall Street.

THE *Evening Scream* states that a professor of history in Stanford University has been examining gold mines at Bullfrog, Nevada. We hope he will not be the victim of either his own enthusiasm or that of others. Professors of history are as appropriate in a gold mine as a bull in a china-shop and as provocative of a smash if taken seriously. Or was it history in the making that the professor was studying on the banks of the Amargosa? He had better avoid such incubators of events, until, like the brine of the desert, they have been distilled by Time.

AMONG the small banks that were overwhelmed by the recent panic was the Swickhimer bank of Rico, in southwestern Colorado. This institution is controlled by David Swickhimer, the man who discovered the Enterprise mine in 1887 and caused the development of Newman hill, at Rico. The same indomitable courage that caused him to stick to his prospecting, in the face of many difficulties, and finally to uncover the ore measures

that made Rico a rich mining district, was made manifest when the financial flurry compelled his bank to suspend payments for a time. It is pleasant to learn that the depositors have such confidence in Mr. Swickhimer that they have arranged to give him a year wherein to arrange matters, and the meeting at which this was decided was marked by an unusal manifestation of goodwill toward the old miner and enthusiastic expressions of faith in his absolute integrity. Even a bank failure may enrich humanity.

NEVADA'S latest discoveries of gold are at Rawhide, a mining camp which is 28 miles east of Schurz, at the head of Walker lake. Like most of the desert goldfields, this new one is lacking in wood and water. Piñon pine sells for $1 per sack and water at $2 per barrel. Coal is worth $45 per ton. This recalls the early days of Tonopah, and, as at Tonopah, the energy of the exploiters of mineral wealth will conquer the natural obstacles, transforming the desolation of the desert into a hive of industry. We wish good luck to Rawhide. At present, the new district is controlled by a few vigorous men and the stock market feature of mining is pleasantly absent. The leasing system is in vogue and good ore is being broken from quartz stringers in andesite.

WE WELCOME the letter by Mr. John A. Reid on 'College Instructors.' Professors are so accustomed to lecturing students that a little of their own medicine may do them good. The best of them will welcome an expression of ideas in regard to teaching when offered by the earnest-minded members of their own classes and among the professors there are not a few possessing the supreme test of the sense of humor, namely, the capacity to see a joke against oneself. Mr. Reid's criticisms and suggestions are made in good faith—for that we vouch—and we are glad of his endorsement of the proposal made by the present writer in another place, to the effect that the chairs of metallurgy and mining in schools of mines ought to be so endowed as to permit of one professor lecturing while the other is in the field, not practising but gathering information at first hand, so that the professor of mining becomes a dual personality and is thus enabled to perform what is now impossible, namely, lecture on theory while in close touch with the practical working of his subject. If Smith and Jones were both appointed to the professorship of metallurgy in the College of Minerva, Smith would devote himself to a term of lecturing while Jones would be at Bingham, Anaconda, or Tennessee studying copper smelting, or at El Oro and Kalgoorlie investigating cyanide practice, or at Wallace and Broken Hill studying the treatment of lead ores. At the end of a semester Jones would arrive at the College bubbling over with ideas and information for the use of his students, while Smith would be released from lecturing and it would be his turn to make a *voyage metallurgique*. The plan is feasible; it would cost about $15,000 per annum, that is, $5000 as salary for each professor and $5000 for traveling expenses. That is all. And it would be better than the erection of a marble palace to commemorate a late lamented or the donation of a library to celebrate the success of a champion rebater.

JAMES J. HILL is quoted as saying that one beneficial result from the curtailment of industry is that "one can get a day's work out of the laboring man these days." Others will echo this statement. The cost of mining has risen seriously by reason of the excessive demands of the labor unions, operators being unwilling to have a strike and interrupt work when the metal markets were at the top notch. Mr. James Douglas is credited with the statement that the cost of producing copper has been advanced three cents per pound during recent years, and in southern Arizona the shortage of fuel, car congestion, and labor troubles have been the main factors in causing this increase. Elsewhere an increase of two cents per pound is a fair estimate, such an addition being due mainly to the higher pay and less efficiency of the wage-earner, together with the increment of cost for all supplies and machinery. Undoubtedly, the labor market has been as demoralized as that of the metals, and efforts to monopolize the one and the other have been equally detrimental to legitimate industry. The mine manager has been between the devil of a tyrannical labor union and the deep sea of unrestrained speculation among metal brokers. He prays to be delivered from both, and it is unfortunate that such relief cannot come save through the drastic discipline of hard times.

AN ALASKAN MINER, under the pseudonym of 'Musher,' writes to suggest that the Survey do a little real prospecting on its own account, by grubstaking a few of the younger members of that scientific bureau. The charge that the Survey reports are so late in their appearance as to serve mainly as obituaries on mining districts is one that might have been made a few years ago, but it is rarely true today; at the risk of seeming inconsistent we venture to say that the reports are now so prompt in their appearance as to be in danger of being compared to 'write-ups,' journalistic performances of an ephemeral kind. As far as our friends the 'mushers' of the North are concerned, surely they have abundant cause to feel grateful to the United States Geological Survey, for the bibliography of Alaskan reports is already voluminous; in fact, on the very day the letter of our correspondent arrived we were making mental note of the splendid mass of information on Alaska given out by the bureau at Washington; why, there is nothing like it, no mining region in the world has been so intelligently and usefully served in the matter of scientific investigation. Alfred H. Brooks and his corps of assistants have not only issued a number of geological monographs of unquestionably great value but they have done some of the very pioneer work mentioned by our correspondent, not, it is true, finding ore deposits, though even that has been done incidentally, but in making surveys and maps of comparatively inaccessible tracts, exploring rivers, climbing mountains, correlating geologic facts, and

co-ordinating all the information extant at the time. No; Mr. Musher, you have barked up the wrong tree.

Federal Bureau of Mines.

BY THE COURTESY of Mr. W. P. Englebright, one of the representatives for California in the Congress of the United States, we are in receipt of a copy of the bill introduced last week for the establishment of a Bureau of Mines in the Department of the Interior. This is the result of several years of work on the part of the American Mining Congress, which at its successive sessions has ventilated the subject, passed resolutions asking for Federal recognition of the mining industry, and urged the creation of a Department of Mines, with a cabinet minister at the head of it. Whatever sins of omission and commission may be charged to the Mining Congress, it is only fair to acknowledge that the near probability of the creation of a mining bureau at Washington is to be credited to Mr. James H. Richards and his friends, who have labored unremittingly for this achievement. And yet the outcome is not exactly what they desired. We are to have a bureau and not a department, it being known that President Roosevelt does not want any more cabinet officers and considers that the Cabinet is already too much like a town meeting. Moreover, every department includes a number of independent bureaus; for example, in the Department of Agriculture there are twelve of them. At present there are but few bureaus at Washington that are so closely related as to be properly included within a Department of Mines. Of such the most important is the Geological Survey, which has close relations with the Land Office, the Forest Service, and a number of other branches of government work, so that at present it would not be likely to be placed within a Department of Mines. The preparation of the general topographic map of the United States, for example, is not related directly to mining; in fact, much of the pressure for this map comes from the general staff of the Army, from educational institutions, from drainage interests, and others not connected with mining. But the strongest argument, to our mind, for the creation of a bureau as against a department, lies in the fact that the chief of the latter is a cabinet officer, who changes with each administration (if not, as according to recent experience, at least twice as often), while a bureau would be headed by one whose appointment would be subject to civil service regulations and, like the Director of the Survey, would be marked by a long tenure of office, independent of the political ebb and flow. While this may render the post less attractive to the ambitious, it will make it more acceptable to the man with an earnest desire to serve the mining industry to the very best of his ability.

So we dismiss the dream of a Mining Department; the near reality of a Bureau will suffice for the present and when the new organization shall have proved itself useful and comprehensive, it will be time enough to revert to the larger idea. There will be difficulty in getting fit men even for the smaller range of activity, for untrained men and politicians are not likely to use their authority wisely and any bureau must depend for good service mainly on its personnel. In this respect, the Geological Survey is now well equipped, despite the allurements of the financial and industrial corporations, which have absorbed so many first-rate scientific investigators.

The new bureau will be mainly technological. First will come the investigation of explosives and the prevention of explosions, as well as other accidents such as have occurred with distressing frequency of late in coal mines. It is likely that the Fuel Testing Plant of the Geological Survey may be made the nucleus for further technological studies and prepare the way for laboratory investigations of a varied character. This is a part of the program for which we have no liking, believing that there is no need to trespass upon private initiative or ask the Government to do what can be done by the professional men to whom such work is a means of honorable livelihood. The lessening of waste, the prevention of accidents, the investigation of resources neglected by private or corporate enterprise, the regulation of conditions underground—these are among the duties fairly within the scope of the Bureau. And there are two more, namely, statistics and labor problems. We know that we offend our Survey friends whenever we attack their performance of statistical work. Not that the results are depreciated, for we hold that it is done better today than ever before, but we insist that the special training and particular aptitude of the geologist makes it desirable that he should be investigating ore deposits instead of chronicling the product of the mine and smelter. It is a human frailty for men to desire success outside of their particular vocation; but despite the excellent work done by Messrs. Lindgren, Graton, and Boutwell in the compilation of statistics, we still begrudge the time that might have been devoted to the elucidation of rock structure and ore occurrence. It is probable that many of our readers share this regret. So we expect to see the statistical work of the Survey transferred to the Mining Bureau and the literature of geology correspondingly enriched by the men relieved of these duties.

Labor problems are always with us, and they increase in complexity. The officers of the Mining Bureau ought to co-operate with the Labor Commissioners of the different States with a view to investigating the causes of unrest and collecting the facts upon which legislative action may be based. The incident at Goldfield gives point to the need for Federal aid. It should be possible to gather facts useful alike to the operators, the labor unions, and the legislators, and beyond these representatives of special interests, it should be possible for the Bureau of Mines to submit such authentic data as will enable the public at large to form a correct opinion and thus become an intelligent force in the settlement of disputes. There are other matters suggested by the presentation of the bill for creating the Bureau of Mines, but they may well be left for a later occasion. At present, the two things to be kept in view are not to impair the usefulness of the Geological Survey and to avoid any trespass upon the province of the practising engineer.

By the Way.

The legislature of the State of Nevada is in special session, convened for the purpose of passing a bill to create a constabulary intended to take the place of the troops, which are to be withdrawn from Goldfield.

The report of the three commissioners sent by the President to Goldfield, Nevada, for the purpose of investigating conditions, has been filed at Washington.

The report says the conditions did not support the general allegations in the Governor's request for troops, nor were his specific statements established to any such extent as to justify his use of these statements for the purpose of getting Federal troops.

It concludes with this recommendation: "But we must firmly believe that upon the assembling of the Legislature, or within a few days thereafter, the troops should be removed, regardless of any request for their retention, that may be made by either the Legislature or the Governor of Nevada, it being the essential that the State of Nevada shall understand the situation completely; shall recognize the fact that there will at that date be thrown upon it, and it alone, the primary responsibility of keeping order, and that, recognizing this responsibility, it may take such action as is the duty of the State and as will be sufficient in the premises."

In his letter to Governor Sparks, after reviewing the steps so far taken in the Goldfield mining trouble, the President continues: "I have just received the report of these three gentlemen (Murray, Smith, and Neill), which sets forth in the most emphatic langnage their belief, after a careful investigation on the ground, that there was no warrant whatever for calling on the President for troops and that the troops should not be kept indefinitely in Goldfield. The report further states that there was no insurrection against the power of the State at the time the troops were called for; that nobody supposed that there was such an insurrection, and that none of the conditions described in sections 5297-8-9 of the Revised Statutes as warranting interference by the Federal Government existed, and that the effort was and is plainly an effort by the State of Nevada to secure the performance by the United States of the ordinary police duties which should, as a matter of course, be performed by Nevada herself."

The report further says: "There is absolntely no question that if the State of Nevada and the county of Esmeralda exercise the powers at their disposal they can maintain satisfactory order in Goldfield; that so far these authorities have done nothing but rely on Federal aid, and their attitude now is expressed by that of refusing to do anything and desiring to throw their own burdens on the Federal Government for the maintenance of those elementary conditions of order for which they, and they only, are responsible.

"The signers of the report express their conviction that the troops should remain in Nevada until the assembling of the Legislature, so as to preserve the *status quo* in order that the Legislature may deal with the situation as it exists, but that shortly thereafter the troops should be removed.

"I agree with the recommendations of this report, of which I inclose a copy, and shall act accordingly. Unless it can be shown that the statements of the report are not in accordance with the facts, it will be incumbent upon the Legislature of Nevada when it convenes itself to provide for enforcement of the laws of the State. The State of Nevada must itself make a resolute effort in good faith to perform the police duties incident to the existence of a strike."

As the operators' association had instigated the call for Federal aid, the commission, on reaching Goldfield, allowed its connsel to present the operators' side of the case fully. This occupied five days. At the end of these hearings, the report says: "Inasmuch as we were by this time satisfied that the mine operators had not in any particular established a case justifying either the bringing or the retention of the troops, we did not deem it necessary to take any extensive evidence on the other side, and the hearing was substantially closed with a brief formal interview with the committee from the miners' union."

Reviewing the conditions leading np to the present strike and since the strike began, November 27 last, the report draws this conclusion: "The action of the mine operators warrants the belief that they had determined upon a reduction of wages and the refusal of employment to members of the Western Federation of Miners, but that they feared to take this course of action unless they had the protection of Federal troops, and that they accordingly laid a plan to secure such troops and put their program into effect."

When the troops arrived the mine operators issued a statement in which they indicated a reduction in miners' wages from $5 to $4 a day, also their intention not to employ miners who belonged to the union. The report adds: "While this cut in wages and refusal to employ members of the Western Federation of Miners was not announced until after the arrival of the troops, every indication confirms the belief that such action was in contemplation before the arrival of the troops, was part of the general plan of the mine operators to establish their independence of the union, and that the coming of the troops was expected and urged by them to make such a plan feasible."

Conditions at Goldfield, the report asserts, did not justify calling for the troops. The single case of the unlawful use of dynamite, which failed to accomplish any damage, was surrounded by such circumstances, the report says, as to raise a reasonable doubt as to the genuineness of the charge that members of the union were responsible. The great bulk of the testimony of the operators tended to show, according to the report, not the existence of past or present disorder, but the possibility of future disturbances should the troops be withdrawn. This view was held by many men of almost all classes, bnt was based on the changed conditions since the troops had arrived—namely, the declaration of the operators reducing wages and refusing to employ nnion men. As to the refusal of the operators to employ union men, the report sets forth a statute of the State prohibiting such discrimination. The commission expresses itself as satisfied that throughout the miners' union there are not over a few hundred men of dangerous type, while the great majority—probably three-fourths of the membership—were conceded to be men of law-abiding tendencies. By permitting their organization to be managed and controlled by men of violent tendencies the union as a body has thus laid itself open to the reproach of being a vicious organization.

"In view of the foregoing facts, we believe there is considerable danger that serious disorders will be attempted if the troops be withdrawn and the mine operators insist on carrying out their publicly announced policy. But if a handful of men have controlled the Goldfield miners' union and committed the organization to indefensible policies and practices, it is no reason why the county of Esmeralda and the State of Nevada should tamely submit to the domination of this same group and should not assert their anthority and power and enforce respect for law and order without support of Federal troops."

Personal.

ALLIENE CASE is here from Nevada.

S. SYKES, of Johannesburg, is at Denver.

S. SERGEANT NEWBURY has returned to Denver from the East.

C. F. NOURSE is now at Kyshtim, in the government of Perm, Russia.

G. M. HILLARY has an office as mining engineer at Chihuahua, Mexico.

N. C. GROCH has left San Juancito, Honduras, and is at Sandusky, Ohio.

RUSSELL T. CORNELL, of New York, is in Sonora, Mexico, on professional work.

JOHN HERRON has been on a visit to Palo Alto. He has returned to El Oro, Mexico.

WM. A. FARISH, JR., has opened an office as mining engineer at El Paso, Texas.

W. H. PAUL is general manager for the Dolores Mines Co., at San Isidro, in Chihuahua.

C. A. PRINGLE, manager of the Calera mine, in Durango, Mexico, is visiting his home at Oakland.

R. M. ATWATER, JR., is now manager for the Black Mountain Mining Co., in Sonora, Mexico.

CHARLES D. KAEDING was in San Francisco for a few days, and has returned to Goldfield, Nevada.

J. W. BRYANT, manager for the Tyee Copper Co., passed through San Francisco on his way to Sinaloa, Mexico.

GEORGE J. GRAHAM is general manager of the Aztec and Mercer San Rafael mines at Ameca, in Jalisco, Mexico.

ALBERT BURCH has gone to the Old Signal mine, in Mohave county, Arizona, where he is directing operations.

E. C. MUSGRAVE, manager for the Deer Lodge Con. Mines Co., in Montana, is recovering from a severe attack of pneumonia.

H. A. SHIPMAN and R. J. GRANT have joined forces under the name of Shipman & Grant, with offices at 520 Ernest & Cranmer Bdg., Denver.

H. L. CHARLES has resigned as general manager for the Bingham Con. Mining & Smelting Co., at Salt Lake, the smelter having been closed down.

BENJ. H. LOEB has resigned as metallurgist for the Reforma Co., of Campo Morado, in Guerrero, Mexico. He is now at the American Club, in Mexico City.

WILLIAM A. POMEROY, on account of ill health, was compelled to resign as manager for the Palmarejo & Mexican Goldfields Ltd. and is now at Palo Alto, California, having recovered from the effects of malaria contracted in Mexico.

ROBERT H. RICHARDS is approaching the completion of his additional volume on 'Ore Dressing,' and has four assistants and part of the time two stenographers at work upon it. He hopes to go to press in the late spring or early summer.

WILLIAM B. FISHER, who for the past two years has been general superintendent of mines for the Federal Mining & Smelting Co. at Wallace, Idaho, has been appointed manager for the Salt Lake Copper Co., with headquarters at Salt Lake, Utah.

J. E. SPURR has made a renewed arrangement as consulting geologist and engineer for the Guggenheim interests. On account of the advanced degree of progress reached in the geological surveys and examinations of the Guggenheim properties he will in the future be able to devote some time to other work.

Obituary.

L. H. WHEELER, superintendent of construction in the Boston Consolidated mill at Garfield, was accidentally killed by the bursting of a steam-pipe in the new plant early last week. Mr. Wheeler has trying out the machinery of of the plant just prior to putting it into regular operation.

Latest Market Reports.

LOCAL METAL PRICES—Jan. 16.

Antimony	12@16c	Quicksilver (flask)	$45.5
Casting Copper	17½@18½c	Spelter	6@ 6.75c
Pig Lead	3.85@ 4.80c	Tin	33@34¼c

ANGLO-AMERICAN SHARES.

Cabled from London.

	Jan. 9. £. s. d.	Jan. 16. £. s. d.
Camp Bird	0 13 3	0 13 6
El Oro	1 2 6	1 2 6
Esperanza	1 7 6	1 7 6
Dolores	0 17 6	1 5 0
Oroville Dredging	0 13 0	0 13 0
Stratton's Independence	0 3 3	0 3 3
Tomboy	1 7 6	1 7 6

(By courtesy of W. P. Bonbright & Co., 24 Broad St., New York.)

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date	Electrolytic Copper	Lead	Spelter	Silver
Jan. 10	14¾	3.61	4.43	54¾
" 11	14¾	3.61	4.48	55¼
" 12	Sunday.	No market.		
" 13	14¾	3.63	4.53	56⅜
" 14	14⅞	3.68	4.58	55⅞
" 15	14⅞	3.68	4.58	55⅝
" 16	14⅞	3.73	4.58	56

SOUTHERN NEVADA STOCKS.

San Francisco, Jan. 16.

Atlanta	$ 32	Laguna	1.00
Belmont	76	Manhattan Con	22
Columbia Mtn	17	Midway	66
Combination Fraction	69	Mizpah Extension	10
Daisy	1.00	Mohawk	11.25
Fairview Eagle	35	Montana Tonopah	1.87½
Florence	4.10	Nevada Hills	2.70
Gold Bar (Bullfrog)	35	Red Top	
Goldfield Con	5.35	Sandstorm	21
Goldfield of Nevada	1.00	Silver Pick	29
Gold Kewanas	33	St. Ives	45
Great Bend	18	Tonopah Extension	1.40
Jim Butler	38	Tonopah of Nevada	5.25
Jumbo		Tramp Con	18
Jumbo Extension	54	West End	30

(By courtesy of W. C. Ralston, 368 Bush St.)

COPPER SHARES—BOSTON.

	Closing prices. Jan. 16.		Closing prices. Jan. 16.
Adventure	2⅝	Michigan	12
Ahmeek	60	Mohawk	55
Allouez	30	Nevada Con	11⅝
Amalgamated	51½	North Butte	51
Arcadian	5⅛	Old Dominion	33¼
Atlantic	11⅞	Osceola	88
Balakiala	3⅞	Parrot	12½
Bingham Con	4⅛	Phœnix	10
Boston Con	1⅜	Quincy	91
Butte Coalition	17¼	Raven	
Calumet & Arizona	109	Rhode Island	
Calumet & Hecla	675	Santa Fe	2¼
Centennial	27¼	Shannon	12
Con. Mercur	33	Superior & Pittsburg	13⅞
Copper Range	61¾	Tamarack	72
Daly-West	8½	Trinity	17⅛
Franklin	9¾	United Copper com	
Granby		Utah Copper	24¼
Greene-Cananea, ctf	7⅛	Victoria	5⅛
Isle Royale	22½	Winona	5¼
Mass	4	Wolverine	125

Publications Received.

'Half a Century of Rope Making' is the title of a handsome booklet issued by the A. Leschen & Sons Rope Co. of St. Louis, Mo. Fifty years ago, in St. Louis, Adolph Leschen began in a small way to manufacture hemp or fibre rope. Today the great manufacturing plant of the A. Leschen & Sons Rope Co. covers thirty-three acres. Four branch houses and twenty-eight agencies handle the product of the works, which is sold not only throughout the United States and Canada, but in all of the South American republics, Mexico, Cuba, the Philippines, South Africa, Japan, Turkey, Egypt, India, and Russia. In addition to a sketch of the history of the company, the booklet contains a finely illustrated description of the wire-rope tramways and cables for other uses manufactured by the company.

General Mining News.

ARIZONA.

COCHISE COUNTY.

Announcement has been made by the managements of the principal mines in the Warren district that the employees will be paid in currency this month; this will cause the disappearance of the clearing-house certificates and denominational drafts that have been used in the district for a number of weeks.—— It is reported that an orebody carrying 15% copper has been found at the 750-ft. level which connects with the Junction shaft of the Bonanza Circle mine.——An orebody over 60 ft. wide has been found in one of the cross-cuts on the 1200-ft. level of the Hoatson mine; in another opening ore carrying 13% copper has been found.—— At the Copper Queen smelter an additional furnace and one converter were to be put into commission on Jan. 10; this would mean the employment of about 15% additional force.—— Work will soon be resumed at the Swisshelm gold mine; the rumor that this property was sold last week has been denied by the owners, W. K. Meade and Ben Heney. It is said that the Western Mines Development Co. about a year ago offered $250,000 for a 60% interest in the property, but the offer was refused.—— At the Claire mine, near Wood canyon, six men are employed, but the force will be increased as soon as buildings now being erected shall have been completed. It is expected to have the first carload of ore ready for shipment in two or three weeks. The new adit is now 170 ft. long, and exposes a pay-streak from 18 to 22 in. wide.—— Litigation over the Sullivan mine, which has prevented work at that property for nearly two years, is at an end; the Duluth-Chiracahua Development Co., which has purchased the mine, is expected soon to begin development work.—— At the Virtue mine operations have been suspended.

GILA COUNTY.

Recent development work at the Iron Cap mine of the National Mining Exploration Co. has given an encouraging result. On the 450-ft. level a drift was begun on a vein that had been cut 600 ft. from the shaft; the vein at that point had been leached, but the drift has penetrated good-grade ore.

GRAHAM COUNTY.

A good body of low-grade copper oxide ore has been found at the Lafave mine, which belongs to the Chase Creek Copper Co.; the new adit is 200 ft. long.——At the Gold Belt mine the shaft has reached a depth of 260 ft.; prospects for the development of an immense body of copper ore are said to be flattering. A carload shipment of ore made recently to the Shannon smelter averaged 18% copper.

MARICOPA COUNTY.

It is reported that Grant Busick, Andrew Joice, and J. A. James are sacking high-grade gold ore at their claims about six miles east of Harqua Hala. The ore is only 4 to 6 in. wide; two or three tons of it have been taken out.——The old Harqua Hala mine has just been put in good condition for stoping ore; at the mill 20 stamps are crushing ore from the Golden Eagle mine and 10 stamps are working on ore from the Harqua Hala mine.

MOHAVE COUNTY.

Although the Gold Road mill is closed, regular shipments of bullion will be made from the property; this bullion will be secured by letting a weak cyanide solution flow over the large dumps and pumping back the percolating water into zinc-vats in which a high recovery of gold will be made. The proeess has already yielded a big bar of bullion. The cost is said to be only a few cents per ton of water handled.——At the mill of the Idaho-Columbus Mining Co. at Cerbat, the roaster and electric separator are working well.——It is said that at the School Marm mine in the Chemehuevis range, E. Frankforter has found the ore-shoot from which much rich gold ore was taken several years ago. ——R. R. Gamey has gone to Los Angeles to purchase machinery for the Gladstone mine at Chloride.

PIMA COUNTY.

Judge Campbell has handed down a decision in favor of Paine, Webber & Co., of New York, in the sum of $272,299.04 against the Copper Bell Mining Co.; the money had been advanced to the latter company by Du Parquet, Huot & Moneuse for development work, and minority stockholders sought to prevent the assignment of the note to the plaintiffs in the action.——The directors of the Twin Buttes Mining Co. have resolved to resume work on their property; 30 or 40 men were to begin work on Jan. 10, and the number was to be increased as rapidly as possible to about 200. William M'Dermott is manager.

PINAL COUNTY.

The smelter being built at Sasco will soon be ready to be blown in. A new concentrating plant is also being constructed; it will be completed in about three months.——Two Keystone drilling plants have been received by the Ray Consolidated Copper Co.; they will be put in operation at once at the Ray mine.

SANTA CRUZ COUNTY.

The Four Metals Mining Co. is planning to further develop the Hillside mine by driving an adit and sinking a winze.——The San Miguel Mining Co., which is operating the California mine, near the Sultana mine, is planning to erect a quartz mill; large bodies of ore are reported blocked out in the mine.

YAVAPAI COUNTY.

Plans are being formulated to pay off the indebtedness in Arizona of the Arizona Smelting Co.; this is to be the preliminary step toward reorganizing the company and resuming operations at the Humboldt smelter.

CALIFORNIA.

AMADOR COUNTY.

In the Fremont mine, the shaft will require re-timbering from the 400 to the 850-ft. level because of a fire; this will require three months. When finished an attempt will be made to remove the debris to get at the bodies of the 11 men who perished at the bottom of the shaft.

EL DORADO COUNTY.

A rich vein of quartz ore is reported to have been found in the Red Hill mine in the Aukum district.——A test run of 100 tons of ore from the Vivian mine has given good results.——Wm. Craddock has driven the Vulture adit over 300 ft.——At the Dormody mine in the Green Valley district two engines have been installed.—— W. C. Covert has bonded the Morey quartz mine in the Grizzly Flat district and will start development work at once.——Work has been resumed with a full force of men at the Sherman mine. ——Lumber is being hauled to the Julian mine in the Pilot Hill district for the new mill which is to be erected soon. ——At the Shamrock-Lipton mine in the Greenwood district ore rich in sulphides has been developed; the company intends to sink several hundred feet deeper on the vein.—— H. H. Laederick is developing a mine in the Greenwood district for Mrs. De la Montanya.——Lee & White are pushing work at the Gilbert mine with encouraging results.

INYO COUNTY.

The Ubehebe Lead Co. is developing several small orebodies at its mine in the Ubehebe district. On the Wedding Stake claim the adit has a face of lead-silver ore; on the Cora claim a 3½-ft. vein of lead ore has been found.—— At the Emerald and Valley View mines, J. P. Hughes has found ore rich in gold, silver, copper, and lead.——At the Salsberry mine a contract has been let for the driving of an adit 500 ft. long.——The Keane Wonder mill has yielded $16,000 as the result of two weeks' run on ore from the Keane Wonder mine; the mill is now treating 75 tons of ore per day, the ore varying in value from $12 to $25 per ton. ——The Greenwater & Death Valley Copper Co. has let a contract for additional sinking of its shaft; it is intended ultimately to reach a depth of 1600 ft.——H. T. Whitworth intends soon to begin developing the Surprise group of claims in the Coso range; mines were worked there by slaves about 1860.——At the Good Hope mine near Skidoo eight men are at work; Edward Hamlin is superintendent.

KERN COUNTY.

A company has been formed in Los Angeles to work the Cottontail placer mine, in the Red Rock Canyon district. Pumps of large capacity will be installed and an effort made to sink shafts to bedrock. Dry washing machines, operated by gasoline power, have been tried on the ground, but the subsoil was found to contain too much moisture for good results; it is now hoped to develop enough water for sluicing purposes.——The Yellow Aster mine and mills are working to their fullest capacity; the supply of water is abundant.——Barney Ostick is keeping a little mill running on ore from the G B mine; the orebody is 5 ft. wide.

MARIPOSA COUNTY.

The 3-stamp mill recently erected at the Eureka and Excelsior mines about seven miles from Mariposa was started on Jan. 7 to crush about 200 tons of ore; assays show this ore to be of high value. Several men are employed at the mines.—Quite a number of small gold nuggets were found on the streets of Hornitos after recent rains; the largest reported weighed nearly an ounce.——A renewal of mining activity along the Merced river because of the building of the Yosemite Valley railroad has resulted in the discovery by Eganhoff Bros. & Kuhn of a vein a foot wide, which is said to carry $100 to $200 gold per ton; a 10-stamp mill is to be erected. A flume is being built to develop water-power and later an electric plant will be installed. ——Extensive improvements are being made at the Mountain King mine.

NEVADA COUNTY.

(Special Correspondence).—At a recent meeting of the Bear River Con. T. Co. the old board of directors was re-elected; it decided to continue active work at the Bear River mine. The adit is in 200 ft. and will be continued to a length of 500 ft. Four large veins have been encountered since the company has commenced operations. When the 500-ft. point is reached cross-cuts will be run to develop the veins.——The Central shaft has intersected a large vein of excellent ore. Considerable virgin territory is being opened up, and an immense quantity of ore has been developed in the upper workings.——A splendid body of ore has been encountered in the Golden Gate mine by W. P. Martin and associates; the shaft is being sunk to greater depth.—— A limited amount of development work is under way at the old Perrin mine.——Good ore is being developed in the Oustomah mine; several men are employed and the mine is looking well.——The mines in the Washington district have been meeting with difficulty in getting water-power since the late storms. Heavy frosts and snows blocked the ditches, forcing the Grey Eagle, Yuba, and other large producers to suspend. Late warm rains have thawed things out and a plentitude of water is now assured.——Considerable placer mining is going on through the county and the season promises to be a notably successful one. Heavy rain in the valleys and much snow on the mountains has insured a sufficient water supply for the season.

Grass Valley, Jan. 13.

The December clean-up of the Delhi mine was the largest of any month since the mine came into the possession of the present company. Everything is running smoothly and the mine is again on a paying basis. Hamilton Eddie is superintendent.——Operations have been suspended at the Alaska mine at Pike City until the arrival of a new electric pump.——At a meeting of the Midas Gold Mining Co. on Jan. 6, arrangements were completed for installing the necessary machinery to sink a shaft to a depth of 600 ft.; the machinery includes a 50-hp. boiler, 30-hp. engine, hoist, and a 4-in. pump. Concrete foundations will be constructed for the heavy machinery.——The South Yuba M. & S. Co. reports that it has developed a 50-ft. vein of valuable copper ore in No. 6 adit of its mine; the directors have decided to drive No. 7 adit from near the bank of the river, thus opening the vein at a great depth.——The Cold Spring Quartz & Channel Mining Co. is operating the Cold Spring drift mine and the Buckeye quartz mine; the latter has recently been unwatered, and surveyed for the purpose of putting it on a steady producing basis. New machinery has been added to the Buckeye mill to enable it to handle a liberal tonnage of ore.——Some good ore is being taken out of the Norambagua mine, where stoping is going on steadily on the north side of the shaft; it is expected that it will yield $60 per ton at the mill.——A 7-ft. lode has been found in a cross-cut at the Arctic mine, near Canyon creek.——A lawsuit is in progress between the Government and the Central Pacific Railroad Co. to set aside a patent to a section of mineral land near Cisco. The land has two mills on it, and miners and prospectors are testifying that the ground is heavily mineralized.——Sinking at the Kenosha mine continues without interruption; the shaft has passed through what the old miners term the 'hard bar' and has penetrated much softer ground. Geo. M. Root is manager.——The break in the North Bloomfield ditch, which caused a temporary shutdown at the Union Blue gravel mine at North Bloomfield, has been repaired; work was resumed at the mine on Jan. 8.——At the Lincoln mine, near Little Deer creek, the shaft is 80 ft. deep and sinking continues; at a depth of 65 ft. a drift was started east on the vein; it exposes an orebody about 11 in. wide in which gold can occasionally be seen. ——Considerable interest is manifested in the discovery of an antimony lode on the Robert Johnson ranch, five miles south of Grass Valley. It is claimed that it has been traced at the surface for a distance of two miles and that the outcrop is wide. Numerous prospect holes are to be sunk to

determine the quality of the ore.——The crushing of 100 tons of ore from the 500-ft. level of the Idaho-Maryland mine has been completed; the results were quite satisfactory. The ore has a width of 18 in. Bray Wilkins is general manager.——Timothy Lyon, of Forest Springs, has sunk a shaft 32 ft. deep on his New Granada claim; it exposes a vein that is 3 to 10 in. wide at the surface but increases in width in going down. It is said to carry from $18 to $50 gold per ton.

PLACER COUNTY.

(Special Correspondence).—The Morning Star drift mine at Last Chance is being cleaned and the old adit repaired preparatory to the resumption of mining.——At the Placer Gravel drift mine 15 men are taking out gravel from both ends of the channel deposit on this property.——The Home Ticket Co. has 12 men blocking out gravel at its drift mine in the Last Chance district.——At the Rublin quartz mine five men are driving an adit on the vein; some good ore is exposed. Snow and ice prevent the operation of the 2-stamp mill.——At the Deadwood drift mine two men are working. ——The 10-stamp mill at the Herman mine is being operated; the machinery for a new power-plant has not all

arrived.——Baird & Partner are working their placer mine in El Dorado canyon.——The Imperial Mining Co. is operating its hydraulic mine on the North Fork of the Middle Fork of American river.——The Three Queens mine at Forest Hill is being systematically developed; some good ore has been found.——At the Gray Eagle mine near North Star the old adit is being repaired.——Joe Bruner and associates are working the Old Drummond mine; at one time this property produced rich ore.

East Auburn, Jan. 12.

SAN BERNARDINO COUNTY.

It is stated that many prospectors and others are hurrying to the site of a new gold strike in the desert country near Manvel. The discovery of a vein the ore of which assays $2200 per ton is the cause of the stampede. Many people have left Needles and Searchlight in automobiles, buggies, and wagons, and on bicycles and burros.

SHASTA COUNTY.

Two carloads of chromite are being prepared by C. F. Dougherty and D. C. Brown at their mine near Castella for shipment to Valley Springs in Calaveras county, near which there is a copper smelter; the chromite is used for lining the four furnaces. The Mammoth smelter at Kennett also receives chromite from the same mine.——At the Midas mine 70 men are employed and the camp is in a flourishing condition.

The new furnace at Heroult is about ready for continuous operation; it is about 20 ft. high and about 10 ft. square and is in the form of a regular blast-furnace.——At the Milton mine in the Lower Springs district, a good orebody has been found in a 50-ft. cross-cut driven from the bottom of the shaft.

SIERRA COUNTY.

Gravel said to contain $200 gold per carload has been found at the Telegraph drift mine. It was opened at a depth of 22 ft. below the main adit. Electric power is being used to haul the cars. The gravel is about 3 ft. thick and as the work progresses it is widening.

SISKIYOU COUNTY.

The Champion Group Mining Co. has purchased the Granite mine on Humbug creek from Bird & Grant and J. E. Harmon; the new owners have several men employed and intend to increase the working force within a short time.——A statement appearing several times in the local press that the Morrison-Carlock mine is closed down is not true.——It is announced that the owners of the King Solomon mine near the South Fork of Salmon river will build a 50-stamp mill if the county will extend a wagon road from the Black Bear mine, a distance of seven miles.

TRINITY COUNTY.

The adit under construction at the Union Hill mine, it is estimated, will be completed in six weeks and then the hydraulic mine will be operated to its full capacity.——Joseph Porter has been appointed superintendent of the Bonanza King mine and will make an inventory of the movable assets, but is not to accept service of any papers; the property is in charge of Supervisor Stoddard, as a keeper for Sheriff Boyce.——At the West Point mine near Deadwood, a body of rich ore was found on Jan. 11. It is over 2 ft. in width and has much gold in a free state. A small force of men has been employed at this property for five months. As soon as weather conditions will permit a boarding house, bunk house, blacksmith shop, and ore-bins will be constructed. Mark Manley is superintendent.

TUOLUMNE COUNTY.

The mill at the Arbona mine is about completed.——Four men are stoping ore at the Gross mine; the mill will be started this week for a month's run.—— E. Murphy of Columbia has a small crew of men working at the Minerva mine, at Italian Bar.—— A 5-stamp mill is nearly completed at the Gem mine, five miles above Sugar Pine, on the North fork of the Tuolumne river.—— At the Old Soulsby mine a pump is being installed at the 600-ft. level in the Davidson shaft.——John N. Lyon, Frank N. Hill, William Blackmar, and John Starr have taken a bond on a portion of the Lewis ranch, near Stent, and propose doing some mining development on it.

VENTURA COUNTY.

It is reported that the Frazier Mountain borax mine will be closed down shortly and probably not operated again before spring. The reasons for the shut-down are the severity of the winter, which makes it difficult to keep up the roads, and also the action of the larger borax companies, which is said to make it hard for the small mine operators to market ore at good prices.——The Columbia borax mine has been closed for more than two months.

IDAHO.

SHOSHONE COUNTY.

The adit of the Golden Winnie tungsten mine, near Murray, is now over 600 ft. long; six men will be kept working in it all winter. It is said that this adit develops a body of ore 200 ft. long and 5 ft. wide, and that this ore carries 12% tungsten. David Gross, the president of the company, expects to make a trip to Germany to negotiate with the Krupp Gun Works company for the disposal of the ore.——The Hecla Mining Co. closed its mine on Dec. 29 for an indefinite period. Of the 155 men who were employed at the mine 20 will be retained to install a large new air-compressor and hoist; this machinery will permit working at a depth of 3000 ft.——The 18,000-lb. transformer from the Kellogg station of the Washington Water Power Co. has been hauled to the Federal mine where it will be installed for the use of the Last Chance mine.——Ore, some of which assays 29% copper, has been found in the Copper Age & Edison mine, near Saltese; the adit is 500 ft. long and work on it will continue with two shifts all winter.

NEVADA.

ESMERALDA COUNTY.

The United States Circuit Court at Carson on Jan. 11 took up the matter of the injunction proceedings against the Western Federation of Miners. The affidavits read to the court tended to show that the union at Goldfield had been the prime factor in all the labor troubles of the camp since its discovery; they accuse the union of having countenanced the action of the high-graders and also of protecting them by its fight against the change-room system. On Jan. 12 it was announced in Washington that President Roosevelt had determined to withdraw the troops from Goldfield shortly after the Nevada Legislature begins its special session. On the same date the report of the committee which has been investigating conditions at Goldfield for the President, was made public. It condemns Nevada for yielding to the vicious domination of a small number of men of violent tendencies who control the union at Goldfield, and scores the mine owners for laying plans to secure the protection of the troops. The Legislature convened on Jan. 14, with nearly all the members present. It is likely that a bill petitioning the Federal Government to establish barracks in the State will be presented; there will also be a fight by supporters of Governor Sparks to establish a troop of rangers on the plan adopted by Texas. The Goldfield labor trouble is making little change from day to day, except that the mine operators seem to be making steady gains that presage ultimate success. The most important move during last week was the importation of 80 good miners from Park City, Utah, to work in the Goldfield district. They were so quietly recruited by George Wingfield that no knowledge of it reached the Goldfield union; consequently, when they arrived there were no pickets on hand; but on the following day 400 pickets swarmed to the hills and at every opportunity tried to get the men to quit work. The men from Utah were Federation men, but before embarking for Goldfield they signed an agreement not to become members of the Goldfield Miners' Union No. 220 or any other union as long as they are working for the company which has imported them. Manager Mackenzie of the Goldfield Consolidated Mines Co. says that there are a thousand men in Utah, all Federation men, who can be enlisted for the Goldfield mines. The local union is visibly discouraged over the developments, for it had boasted that the mine operators would be unable to get good miners to come into the district; but it seems to have been mistaken in the matter of the Utah men.

The Goldfield mines are again on a producing basis. On

Jan. 11 the Western Ore Purchasing Co.'s plant at Columbia was still closed, but the company was taking all ore offered and handling it at Miller. Since Jan. 1 it received 100 tons from the Florence-Annex lease, of an average value of $100 per ton, and from the Mohawk-Combination mine 60 tons of $50 grade. The Little Florence company shipped 1035 tons of an estimated value of $207,000 to Denver for treatment; this had been produced before the suspension of work due to the miners' strike. Since Dec. 12 the Combination mill has treated an average of 80 tons daily; the average value is placed at $40 per ton.——The Florence-Gem Leasing Co., which recently took over the old Watson lease on Florence ground, has opened ore on three levels; on the 50-ft. level the ore is medium-grade; on the 100-ft. level it runs up to $100 per ton; and on the 150-ft. level there is a 12-in. streak of ore that assays $628 per ton. It is supposed to be a continuation of the Jumbo lode, from which lessees took fortunes in the early days of the camp.—— The superstructure for the Florence mill is completed and the machinery is being assembled; the arrival of the machinery was delayed through its having been lost between Denver and Goldfield, and it will be at least three months before the mill can be crushing ore.—— Work on the properties of the Goldfield Consolidated Mines Co. is being gradually resumed; between 200 and 300 men are employed. Sinking is under way in the main shaft of the Mohawk mine as well as development of the orebodies on the lower levels. Operations at the Red Top mine were to be resumed on Jan. 11. Grading for the new mill was to be started several days later; a large force of men will be employed constantly from the time the first shovelful of dirt is thrown until the mill is completed.—— It is reported that in the Wasson adit of the Pittsburg-Silver Peak mine an orebody 2½ ft. wide and of an average value of $140 per ton has been found. On Jan. 10, 60 stamps of the mill began crushing ore, and it is expected that the entire mill will be in operation by Feb. 1; the cyanide plant will be completed shortly.—— In the Rawhide district, the lode on the Royal & Tiger group of claims has been traced, it is said, 2100 ft. At one point it is 12 ft. wide. The Robbins lease has an orebody 2 ft. wide that is said to carry $500 per ton; on the Packard lease there is an 18-in. streak of ore which, it is alleged, carries over 1000 oz. silver and 1 oz. gold per ton.—— On the Poor Boy claim 20 lessees are working; the shaft at the Montana lease is 50 ft. deep.——Assays from the latest strike at the Kearns lease on Balloon hill indicate very rich ore.

EUREKA COUNTY.

During the past five months large quantities of ore have been shipped from the mines of the Richmond-Eureka Mining Co. at Eureka to the smelter; plans have just been perfected for increased facilities for the handling of upward of 500 tons per day. The town of Eureka has been revived through the renewed activities in these mines.

HUMBOLDT COUNTY.

The Mazuma Hills Mining Co. has made its fourth shipment of high-grade ore; this was secured mainly in the course of development work in a winze and drifts connecting with the lower adit.——It is reported that a large body of ore of good milling grade has been found on the 150-ft. level of the Seven Troughs Eclipse mine; a milling test is being made on it and if the result is satisfactory, a mill will be erected on the property.

NYE COUNTY.

The ore shipments over the Tonopah & Goldfield Railroad for the week ending Jan. 9, as reported by the Western Ore Purchasing Co., aggregated 380 tons, divided as follows: Jim Butler, 41 tons; Tonopah Extension, 95; Midway, 203; West End, 41. The Tonopah company sent 3050 tons, the Belmont 800 tons, and the Montana-Tonopah 500 tons to the mills, a total of 4350 tons. The total output of the Tonopah mines was 4730 tons, of an estimated value (the shipping ore being valued at $50 a ton and the milling ore at $20 a ton) of $106,000.——Development work is progressing as usual at the Tonopah Extension mine; the north cross-cut on the 1050-ft. level is being pushed rapidly and good progress is being made in the west drift on the 600-ft. level.—— Work in the West End Consolidated mine is being confined to the stopes above the 400-ft. level and to the drifts and crosscuts on that level west of the shaft.——The North Star mine is yielding some shipping ore of very good grade.—— At the Manhattan-Virginia mine, cross-cutting the outcrop for the purpose of holding the ground free from claim-jumpers has demonstrated that the lode is from 12 to 15 ft. wide and that it carries sufficient gold to warrant ore shipments to local mills.——A regular daily output of 25 tons of ore is being maintained at the Ross-Nash lease on the Union No. 4 claim of the Union Extension Mining Co. Sinking has been interrupted by a voluminous flow of water, but as soon as pumps have been installed the shaft is to be sunk to the 115-ft. point.——Work at blocks 13 and 14 on Union No. 9 claim at Manhatten is confined at present to retimbering and straightening the 200-ft. shaft.; a steam-hoisting plant will be installed.——Preliminary work has been started for the erection of the Mayflower mill in the Bullfrog district. The contract for the machinery has been let. The process will be crushing by stamps, amalgamation, and cyanidation with agitation. The water which was encountered in the Mayflower shaft at a depth of 500 ft. will, it is thought, furnish an ample supply for all mill purposes.——J. E. Burch has decided to establish a custom milling plant in Rhyolite; the initial unit will have a capacity of at least 50 tons daily.——Taylor & Griffiths have let a contract to Bruce Crofoot to sink an additional 100 ft. to the 300-ft. shaft of the Alliance mine.——The Gold Center adit in Bare mountain is 500 ft. long; work on it is being pushed as rapidly as it can be done by hand.——Work has been resumed at the Taylor Bullfrog mine.——The Bullfrog Pioneer L. & M. Co., which recently secured a lease on the Bi-Metallic mine, is making arrangements to install a 25-ton cyanide plant and a 15-hp. hoist; it expects later to add an air-compressor plant. The lease is said to have developed

The Troops at Goldfield.

Montana-Tonopah Mine.

an immense body of ore carrying from $5 to $15 gold per ton. ——The Gold Bar mill is complete, locked up, and ready to run.——The branch of the Nevada-California Power Co.'s line, which is to carry electricity to the Gold Bar and Homestake mills, is nearly completed. Delay in starting the mill may be caused by the non-arrival of pumps for the water system.——At the Homestake mill excavating for the foundation is almost completed and the cement work is under way.——Work has been temporarily stopped at the Bullfrog Keystone mine pending a decision as to the best plan for future development.——The lessees at the Gibraltar mine are preparing to make another shipment of ore before long.——At the Golden Scepter mine at Rhyolite work has been resumed in the new adit which is being driven in the Hobo vein.——At the Badger lease on the Ramsay mine near Willow creek, a shipment of several carloads of high-grade ore is being assembled.——Preparations are under way for the erection of the Robinson custom mill at Midas. At Red Mountain, the Hercules Syndicate Mining Co. has had a force of miners at work for four months; the main shaft is now 60 ft. deep.——Freezing of the water in the pipeline of the hydraulic mine in the Round Mountain district caused a suspension of operations early in January, but work has been resumed. At the Congress mine, at Johnnie the old shaft has been cleaned out and driving has been started from the bottom.——The westward drift at the 200-ft. level of the Mineral Hill mine near Manhattan is in ore that yields gold in the pan; the drift will be continued at least 200 ft. farther before sinking will be undertaken.

STOREY COUNTY.

The Yellow Jacket mine is about to take on new life through the building of a mill to treat the ore. On the 1100-ft. level of the mine there is developed a vein from 10 to 18 ft. wide; assays indicate that it carries from $3.41 to $14.62 per ton, of which 9⅀% is gold. It extends downward as far as the 3000-ft. level, and some of it was extracted from the 1400-ft. level and sent to the Carson River mills; owing to a milling charge of $7 per ton, railroad freight, and the high cost of steam-power for hoisting, it was impossible to make a profit. With the Yellow Jacket mill on the ground, and with electric power, the ore can be profitably worked.—— At the Ward mine there is being constructed an annex to the main hoisting works to accommodate the engine from the Ophir; the shaft will be sunk to the 3000-ft. level.

WASHOE COUNTY.

Ore is being sacked by M. G. Churchwood and Charles F. Mitchell at their new mine about midway between Verdi and Reno. The lode is between porphyry and limestone, and consists of reddish-brown quartz carrying gold and silver to a value of about $30 per ton.—— The 2-stamp mill at Derby has been crushing ore from the Renegade mine at Olinghouse; 12 tons of the ore yielded $700 gold.

SOUTH DAKOTA.

LAWRENCE COUNTY.

The Mogul mill, which was rebuilt from a chlorination to a cyanide plant, using rolls and Chilean mills for crushing, handling the sand in vats and the slime by the Moore process, was put in operation about three months ago. It was designed to have a capacity of 300 tons per 24 hours, and it is interesting to note that the average capacity for November was 330 tons per day.——The Imperial Mining Co. is diligently pursuing work in the Dakota shaft on Bald mountain; the shaft has now reached a depth of 430 ft. but is not expected to penetrate ore until it is 500 ft. deep.——It is said that after two years of work, the Mariposa Mining Co. has found the vein for which it was searching and has developed a good body of ore.

WASHINGTON.

OKANOGAN COUNTY.

(Special Correspondence).—The Grant Consolidated Mining Co. has driven an adit about 500 ft. long at its mine; 45 ft. of it is in an orebody of which the hanging-wall is not exposed. The vein for which the adit has been driven should be reached at about 600 ft. from the portal.——Work has been temporarily suspended at the Copper World Extension mine; it is reported that a diamond-drill will be used for prospecting below the 300-ft. level.——At the Butcher Boy mine the working force has been increased; the adit has been connected with the shaft on the 100-ft. level. An ore-bin has been constructed and shipping of ore will be resumed shortly.——A steam-engine, boiler, and air-compressor have been installed at the Olentangy mine.—— Work has been resumed in the upper adit of the Bluffton mine; some good ore has been found.——The Molson Mining Co. has purchased new machinery for its mill.

Republic, Jan. 13.

STEVENS COUNTY.

(Special Correspondence).—The Ark group of claims has passed to a new company; a hoist and compressor plant have been installed. A new shaft is being sunk on a vein of ore containing gray copper and assaying $146 per ton. Several tons of copper ore are ready for shipment.——The Young America mine at Bossburg has been sold to a New York company and is to be reopened.——Work is to be resumed shortly on the Butte & Chief mine with a large force.——The adit of the Globe mine is being driven on copper-gold ore, interspersed with galena.——Development work has been resumed at the Trojan mine, under the supervision of L. Larsen.——The Viking Copper Mining Co. is planning to expend $10,000 for equipment and development of its claims three miles from Orient; it is intended to drive the present adit 500 ft. farther.——In the adit of the Paymaster mine, on Toulon Mtn., galena ore containing chalcopyrite has been unexpectedly found.——From the First Thought mine ore is being shipped; some of it runs as high as $100 per ton.——The Trophy Gold M. & M. Co. has let a contract to sink 50 ft. on the Wild Rose claim. ——Arrangements have been made to resume work at the Swamp King, a rich gold property northeast of Rockcut.

Republic, Jan. 2.

CANADA.

BRITISH COLUMBIA.

The Granby Consolidated M. & S. Co. has begun shipping ore over the railways at the rate of 1000 tons daily. About 300 men are employed at the mine; men are arriving in camp every day. On Jan. 2 two furnaces were blown in at the smelter, to be followed by the remaining six in due time, as the ore shipments are increased.——The Strathmore mine has been closed; it is likely that some diamond-drilling will be done on the property.——The Le Roi No. 2 mine at Rossland is increasing its shipments. The ore carries much gold and silver.——Another large orebody has been found at the North Star mine; from this mine there were shipped about 3000 tons of ore during last year.—— Operations at the La Plata mine near Nelson have been temporarily discontinued; there is a large supply of ore at the mine but the present prices of silver and lead are not tempting.——At the Richmond-Eureka mine the new tramway that is being built by the W. S. Riblet Tramway Co. is nearly completed; when it is finished, the company will be able to ship a considerable quantity of galena to the Trail smelter.——A new 80-hp. boiler has been installed at the Charles Dickens mine; this will make feasible the mining of ore on the lower levels. In a short time the plant will be handling 150 tons of ore per day, making 10 tons of concentrate. Ore is being shipped daily; 34 men are employed.——The ore shipments in the Cranbrook district for the week ending Jan. 4 were as follows: St. Eugene, 600 tons: Sullivan, 600.

YUKON.

The Yukon Gold Co. has begun putting on a full force of men for winter hauling in the Twelve-mile district. The trail is now first-class for freighting; 2500 tons of iron pipe, wooden staves, mess-house material, and other freight must be moved from Twelve-mile Landing before summer to permit rapid progress in the construction of the ditch which is to supply water for mining on Hunker and Bonanza creeks. In the Ballarat district 75 men and 60 horses have been busy handling lumber and it will be necessary to put on an additional 50 men.

Special Correspondence.

London.

Sodium Cyanide.—The Sulphide Corporation. — Poor Results. — The Cattermole Process and the Zinc Corporation. — Procrustian Methods.

The Cassel Cyanide Co., of Glasgow, is doing remarkably well with the manufacture of sodium cyanide. Cyanide manufacturers complain of the competition in their trade and of consequently decreased profits, and another maker in Scotland has been forced to go out of the business. The Cassel company, on the other hand, is able to show an increased profit. For the year ended September 30 last, the gross profit was £69,726, out of which £20,000 was written off for depreciation of machinery, buildings, etc., and £5526 devoted to administration expenses, leaving a net devisable profit of £44,200. Of this sum, dividends and bonuses amounting to £35,250 have been paid, the rate being 40% on the issued capital of £88,125. A year ago the dividends were £22,000, and the year before £17,250. The company has a reserve fund of £20,000, formed during the last two years out of profits, and the plant has been continually improved, also out of profits, so that the company stands in a sound position. It will be remembered that the name of the company has only recently been in its present form. Before 1906, for 22 years the company was known as the Cassel Gold Extracting Co. When the MacArthur-Forrest patents expired or became valueless in other ways, the attention of the directors was turned to the manufacture of cyanide. The details of the process adopted are not published, but presumably it is a process in which the cyanide products of blast-furnace gases are acted on by metallic sodium. The company has a working arrangement with the Castner Kellner Alkali Co., which makes metallic sodium electrolytically. It is interesting to note that the blast-furnaces in the Glasgow and South Scotland district use raw bituminous coal and their gases are of special value. The plants for the recovery of by-products are very extensive and probably the iron-masters obtain as large a profit out of their by-products as they do out of the iron.

One of the standing mysteries of the London mining and metallurgical world is the inability of the Sulphide Corporation to pay dividends on its ordinary shares. The company was formed in 1895 to acquire the Central mine at Broken Hill and the Ashcroft process for treating zinc-lead ores. It was floated by the Exploration Co. in Hamilton Smith's time, conjointly with Antony Gibbs & Sons, of London, and Gibbs, Bright & Co., of Melbourne. Later on the Ashcroft process was abandoned and about the same time the Exploration Co. handed the control to the Gibbs houses. The capital consists of 550,000 preference shares of £1 each, entitled to 10% dividend and an equal amount of ordinary shares of 15s. each. In addition there are £79,600 in debentures outstanding carrying 5% interest. The Central mine is undoubtedly a very valuable property. In fact, mining men who know the district consider it to be equal to the Proprietary. Large amounts of lead and silver are produced every year and profits are realized on the mining and smelting operations. The quantity of ore still in the mine and laid open by current developments is very extensive. But all the advantages of having such valuable ores are neutralized by the expenditure of gigantic sums from time to time on new plants of all sorts and on putting the mine into order. If it may be said without offence, the company suffers from the effect of the other interests of the controllers. Gibbs, Bright & Co. are the commercial agents of the company and as such make profits out of the business of the company in various ways. They are also financially interested in syndicates owning patents for treating zinc-lead ores and their judgment and the judgment of the directors and managers are naturally biased in favor of these particular processes. For some years the Sulphide Corporation has been saddled in this way with the Cattermole flotation process for treating the zinc tailing. The directors say very little about the results obtained by this process, but it is a matter of common knowledge that the recovery is far from satisfactory. The experience of the Zinc Corporation has shown this. It will be remembered that the latter company was formed by Bewick, Moreing & Co. and their friends to treat zinc tailing at Broken Hill. At first the Potter process was tried and abandoned. Then the plant was modified to the Cattermole principle. A very few weeks' experience was enough for Bewick, Moreing & Co.'s engineers, and this process was quickly dropped. It happens also that some of the Bewick, Moreing group have financial interests in the syndicate operating the patents, but they were wise enough not to force forward a process for their own interests when they found that the process would not give satisfaction to the shareholders of the Zinc Corporation. Instead of doing so, they experimented on still further new processes, and found that the Elmore vacuum plant would give far better separation of the zinc sulphides. Consequently, they recommended this process in place of that which they had originally backed, and a large installation is now on its way out. I would say, quite respectfully, to the Gibbs control: "Go and do likewise." It is always a mistake for directors or managers of a mine to have prepossessions and predispositions in favor of particular processes. It means that the mine has to be altered to suit the process. Procrustes used to cut off or elongate the legs of his guests so as to make them fit his bed. If the Gibbs control would cease trying to fit the mine to their processes and their other interests, it would be so much the better for the mine and for the shareholders.

Chicago.

The Interstate Agreement.—Adjustment of Wages in the Coal Regions. —Conditions in Illinois.—Mitchell's Successor.—Prosperity of the Coal Industry.—Mineral Output of Illinois.

As the year came to a close the principal question among mining men here was whether the Interstate Agreement is to be renewed. It will be remembered that the system of collective bargaining originated in Illinois, or at least was here first applied to the coal business in a large way. As the thicker and more cheaply mined coals of the central and southern parts of the State came to be exploited the operators in the northern or thin-vein fields began to feel the pinch of competition. At an opportune time the United Mine Workers came to the front with the proposition for collective bargaining, which involved the regulation of competition between districts by means of adjustment of wages. Later the same system was extended to neighboring States, the two-year labor contracts being based on an agreement made in a convention representing the miners and operators of western Pennsylvania, Ohio, Indiana, and Illinois—the so-called 'central competitive district.' In this convention the basing rate was fixed for each State and wages were raised or lowered from time to time. In Illinois the basing rate is for Danville, and in a later State convention it has been customary to fix rates in other districts of the State relative to the Danville rate; preserving the central idea of bringing about as nearly as possible fair competition between

the various districts. It required sacrifices to establish this system, which, on the whole, all agree, has worked fairly well. The Illinois operators in their perhaps over-eagerness to get the system going, practically gave up the chances for introducing machine-mining and for payment on any but a mine-run basis. For years they have been fighting to regain this ground, since changed conditions make pick-mining even more desirable than formerly. That a run-of-mine system of payment is wasteful and extravagant requires no argument.

In 1906 the Illinois operators refused to grant an increase of wages unless concessions were made on these points. The Pennsylvania operators, led by Robbins, of the Pittsburg Coal Co., refused to stand with them, made separate agreements with the men, and so the Interstate Agreement went to pieces. The various State organizations have, however, been kept up, and in Illinois, at least, the operators are probably better organized and prepared for a fight than they ever have been. The United Mine Workers have been trying ever since the settlement of the last strike to secure a renewal of the Interstate Agreement. While it is not now nearly so important as it formerly was, there are probably certain advantages to all concerned in having it renewed. Two weeks ago a meeting was held at Indianapolis to consider the matter, but no agreement was reached. The Illinois operators refuse to come into any new arrangement without some substantial concessions on the two points in dispute, and temporarily the matter is in abeyance. No one thinks, however, that it will be dropped, and while a guess now is a guess only, it seems likely that eventually the agreement will be re-established and the Illinois operators will win their coveted double scale permitting payment for screened coal.

The whole matter of the Interstate Agreement is more or less tangled up with politics inside the miners' organization. As is well known, Mr. Mitchell has declined to serve longer as president. His career has been a long and honorable one, and he has been a great steadying force in the industry. When recently he was recovering from a dangerous illness there was an outburst of congratulation from all sides, which was as genuine and spontaneous among the operators and the general public as among the miners. Mr. Mitchell's closest associates have been Mr. Wilson, now congressman and secretary and treasurer, and Mr. Ryan, of the Illinois local. These men are candidates respectively for the positions of president and secretary-treasurer of the national organization. They are strong men who, if elected, will follow in the wise footsteps of their leader. The opposition is headed by Mr. Lewis, now vice-president, who is regarded by the operators as a much more radical man and who, if elected, would probably materially disturb existing relations. It is too soon to say who is to be the winner.

Taken as a whole, 1907 has been an exceedingly prosperous year for the coal industry of Illinois. David Ross, secretary of the Bureau of Labor Statistics, recently presented statistics showing that for the year ending June 30, 1907, the production was 47,798,621 tons, as compared with 38,317,581 tons for the year ending June 30, 1906. For the calendar year of 1906 the production was 41,480,104 tons. If the same amount of increase was made for the last half of the year the tonnage for 1907 should run somewhat over 50,000,000, and that would probably again place Illinois in second place. The fall has been very busy and last summer was an unusual one, so that it is not unlikely that this will be the result.

The second big increase in the mineral output of Illinois in 1907 will be shown by the oil. These fields, which were only discovered in 1905, and which in 1906 produced 4,397,050 bbl., have had a remarkable development since. This production for 1907 will run somewhat over 24,000,000 bbl. The oil is of good grade, about 32 gravity, and sells for 68c. per bbl., so that this adds materially to the year's total. The remaining mineral industries of the State have done well, but there are no such remarkable increases as in coal and oil. One new portland cement plant has been built and several of the old lead-zinc mines near Galena have been reopened. The fluorspar mines have made their customary contribution and heavy building operations have made large demands on the quarries and clay pits. In general the year has been a good one, though as elsewhere there has been a distinct check in the last few months.

Rossland, British Columbia.

General Progress.—Mining at Rossland.—The Consolidated Co.—Le Roi.—The Boundary District.—Electric Installations.—The Slocan District.

Had the year which has just closed not been fraught with many circumstances adverse to the mining and smelting industry of British Columbia, the output for 1907 would have been an exceptional one indeed. The operating companies had to contend with a serious strike in the Crows Nest coalfield in the earlier part of the year and an almost continuous shortage of cars, both of these bringing about a scarcity of coke for the smelters and other fuel for the mines; and yet they have done well, for the output from the Yale-Kootenay district almost equals that of 1906, although the mines and smelters were only operating part of the time during nearly three months of the year. At Rossland a decided step forward has been taken by the mines. The Con. Mining & Smelting Co. of Canada has led the pace. They have acquired a large number of the claims adjoining their Centre Star-War Eagle properties, installed a 1000-hp. hoisting plant and greatly supplemented their electrical and air-compressing equipment. At the present time they are to a depth of 2000 ft. and have more ore in sight than ever before. The Le Roi Co. had no need to add to its already well-equipped power and hoisting plant. The principal work was the sinking of the main shaft from the 1450 to the 2000-ft. level and the exploration of the intervening ground by means of drifts, winzes, diamond-drill, etc. The mine is looking well. Le Roi No. 2 worked steadily and made money for the shareholders. The other properties did fairly well.

In the Boundary country the Granby people added materially to their smelting, hoisting, and ore-crushing machinery. The six crushers now in use at the mines have 42 by 30 in. receiving capacity and weigh 56½ tons. Their excellent air-compressing and electrical plant was not augmented to any notable degree. Steam is rather a waning power in this district. The power now used by all recent installations is electricity, which is generated at Bonnington Falls near Rossland, and carried to the Boundary by a heavy transmission line. The Granby people also acquired a number of claims adjacent to their Phœnix mines and now have enough ore in reserve to run their plant for 10 or 15 years. The Consolidated Mining & Smelting Co. (the stock of which is largely held by prominent C. P. R. men) has also taken over a large number of claims at Phœnix; a large air-compressor has been added and electrical locomotives for underground haulage on the Snowshoe group. It is expected that great headway will be made in 1908. The B. C. Copper Co. has gone ahead steadily and only recently found it necessary to increase its crushing plant by a 56½-ton crusher and a big compound air-compressor. The Mother Lode mine is looking well, with plenty of ore in reserve. The Dominion Copper Co. did

a lot of work during the year. They added to their smelter capacity, made it more up-to-date, and installed two compound air-compressors, electrically driven, at their Sunset and Idaho mines. They are at present closed down and have not been operating since the early autumn.

In the Slocan district, the famous St. Eugene, Canada's premier silver-lead property, has been operated steadily and has made lots of money for the Con. M. & S. Co. of Canada, by whom it is controlled. Incidentally, it may be noted that in addition to the properties at Rossland, Phœnix, and Moyie, the Consolidated Co. operates an up-to-date smelting and refining plant at Trail near Rossland. Fine gold and silver from these works are furnished to the Canadian Mint and are marketed in the United States and China.

The Sullivan group of mines and smelter at Marysville were run steadily during the year and did well. The smelting plant was brought up to a higher standard and a great amount of development work in the mines is planned for the early part of the present year. A. I. Goodell, who has spent the best part of his life in dealing with lead ores, is now in charge and it is reasonably expected that a good showing will be made. Great activity was shown among the smaller silver-lead prop-

Map of Part of British Columbia.

erties and the next couple of years should see many prospects blossom into producing mines. Ore shipments from the district ran as follows:

Rossland, gold-copper	283,340 tons
Boundary, copper-gold	1,148,337 "
Slocan-E. Kootenay, mostly silver-lead	185,857 "

The coal mines have been working steadily for the past six months, but several have recently closed down, temporarily. The principal mines, those of the Crows Nest Co., are working, as well as those of the International Co. The Granby company has just resumed operation after a shut-down of six or seven weeks. It is expected that the B. C. Copper and Dominion Copper mines will start to work again within the next six or eight weeks.

A couple of years ago the Canadian Government, to assist the lead-silver miners of this country, voted $2,500,000 for a bounty to stimulate the industry. The bounty was payable on a sliding scale; the higher lead went, the smaller the bounty.

Salt Lake, Utah.

Smelting Conditions.—Shipments from Tintic.—Lower Mammoth Co. —Uncertainty as to Future of Smelting Business.—Boston Con. Mill.—Silver King Coalition.—An Association of Mine Operators.

One Utah mining company posted a dividend during the past week—the Colorado; the amount was 5 cents per share, or $50,000. Although this company is one of the clients of the United States Smelting, Refining & Mining Co., recently ordered to cease shipments of ore, the directors deemed it advisable to share profits with stockholders. The treasury of the company is in a healthy condition. Production may not be resumed again until the new smelter of the Tintic Smelting Co. is ready, which will be in April. This smelter is being erected within a few miles of the mine, and the equipment is on the ground.

Ore shipments from the Tintic were a little larger last week, this being due to the heavy draught made on the Centennial Eureka mine of the United States Smelting, Refining & Mining Co., a portion of the ore being diverted to Kennett, California. The mines shipping and the respective amounts were: Bullion Beck, 4; Carisa, 2; Centennial Eureka, 44; Eureka Hill, 2; Mammoth, 29; May Day, 3; Tintic Iron, 4; Yankee Con., 3; Colorado, 4; total, 95 carloads.— —The shaft at the Opex mine has been completed to a depth of 1300 ft., and the management is exploring the various levels with encouraging results. This mine is owned largely by Salt Lake people; but F. Augustus Heinze is a shareholder. Many believe it to be one of the best mines in the Tintic district. The ore is similar to that of the Centennial Eureka mine.

In order to carry on development while the mine is not producing, the directors of the Lower Mammoth Mining Co. have called a special meeting of shareholders for February 5, at which time the proposal to increase the capital stock of the organization from 190,000 shares to 250,000 shares will come up for consideration. It is also proposed to issue $80,000 worth of convertible bonds. The Lower Mammoth mine is at Tintic and has been opened to a depth of 1800 feet.

The United States Smelting, Refining & Mining Co. is still operating its copper and lead smelter in the Salt Lake valley; but no ore is being received; it is probable, therefore, that within a few weeks, at the most, the plant will be idle. The plans of the company for the future are not known. It is believed that the lead smelter, at least, will resume operations soon after the shut-down. It seems unlikely that the Murray plant of the American Smelting & Refining Co. will be permitted to operate and the United States company denied the privilege.

The Boston Consolidated Mining Co. has a portion of its new mill at Garfield in operation. By the end of the month it is expected that at least three sections will be running on ore and giving treatment to 1500 tons per day. At the Boston Con. mine at Bingham about 250 men are employed.—— The New England mine at Bingham is still producing ore, notwithstanding the low metal market, and is continuing vigorous development. The Utah Apex has a large force on development; the Phœnix mill is nearing completion, and will probably be ready within a month. The mill will have a capacity of 200 tons. The Utah Consolidated management has mapped out a campaign of development. Just what will be done about the construction of a new smelter has not been decided, but the matter will undoubtedly be settled during the present month. The American Smelting & Refining Co., however, has been after Utah Consolidated ore, and the officers of the latter company have been approached on the subject. Unless the American will consent to a very favorable contract, there will be no change in the plans for the new smelter.

The Silver King Coalition Mines Co., of Park City, will have to make an accounting for ores extracted from the Arthur and Conkling claims. A suit has been filed in the Federal Court in which N. Treweek and J. Leonard Burch appear as plaintiffs, and allege the ownership of a three-quarters interest in the property, and that 10,000 tons of ore of the value of $40 per ton has been extracted, for which there has been no division of profits. The ore is alleged to have been mined and milled by the Keath-Kearns Mining Co., which has since been absorbed by the Coalition company. The directors of the Silver-King have passed the usual quarterly dividend, giving as a reason the unsatisfactory smelting and metal market conditions.—— A meeting of the ore producers of the State will be held at the Commercial Club in this city on the 15th inst., for the purpose of organizing a State association. In view of the recent effort of smelting companies operating in the Salt Lake valley to increase treatment charges on ore, mine owners are enthusiastic over the proposition of forming an association.——The May Day, Uncle Sam Consolidated, Victoria, and Grand Central Mining companies, all owning mines in the Tintic district, have passed the January dividends.

The directors of the West Mountain Placer Mining Co. are expected to post a dividend of $5000 during the week. This corporation derives its revenue from the lease of certain water rights and lands to the Utah Copper Co. in Bingham canyon.—— The Utah Copper Co. closed the year 1907 with a production of 15,000,000 lb. copper. In December the output was 3,000,000 lb., and the cost of mining 31 cents per ton.

Leadville, Colorado.

Annual Record.—Effect of Drooping Metal Prices.—The Yak Tunnel.—Zinc Ore Concentrators.

The official returns from the various mines of the Leadville district show a slight falling off in tonnage as compared with the previous year, but an unusual amount of development work was accomplished, which, with a restoration of prices, should give the district during the present year its old standing. The low prices for zinc and lead ores during the last two months has forced the large producers to curtail their output materially. The following is a summary of the various classes of ores produced in the district during the year 1907:

Kind of ore.	Tons.
Siliceous	119,000
Oxidized iron	123,400
Sulphide	233,500
Carbonate	39,600
Manganese	21,000
Zinc	136,000
Total	675,500

Among the principal producers are the following:

Company.	Tons.
Yak M. M. & T. Co	89,000
Ibex Mining Co	62,200
Western Mining Co	55,400
Midas Mining Co	80,800
A. Y. & Minnie	30,900
Iron Silver Mining Co	101,500
Morning Star Mining Co	37,000
New Monarch Mining Co	17,300

The products were as follows:

Gold	56,137 oz.
Silver	5,298,922 "
Lead	45,893,669 lb.
Copper	5,908,154 "
Spelter	71,152,400 "
Manganese	24,000 tons

Practically all the ores of the district were treated by the American Smelting & Refining Co., the Empire Zinc Co., the United States Smelting Co., and the Ohio & Colorado Smelting & Refining Co. The year witnessed an unusual advance in prospecting and development work. The Yak enterprise stands paramount. This company has extended its operations during the past year in various directions and is still extending its laterals at the rate of 250 to 300 ft. each month. The adit is at the present time over 2½ miles long; it has crossed the Ibex ground and is pushing toward the north. Among the laterals those into the North Moyer, White Cap, Belgian-Frenchman, and N. M. Fraction are among the most important to the Breece Hill producers. This company has adopted electric power and is furnishing a large number of producers in this and adjoining districts with power; however, its electric plant is now merged into the Central Colorado Power Co. During the year large mills were erected by the Leadville District M. & M. Co. and the A. M. W. Mining Co. for the treatment of zinc ores, the former to treat the Ibex dump and the latter the Adams zinc sulphides.

Chihuahua, Mexico.

San Toy Mines.—The Encinillas Co.—Sierra Mojada.—The Almoloya District.—Dolores.—Some News From Zacatecas.—The Benito Juarez Mines.

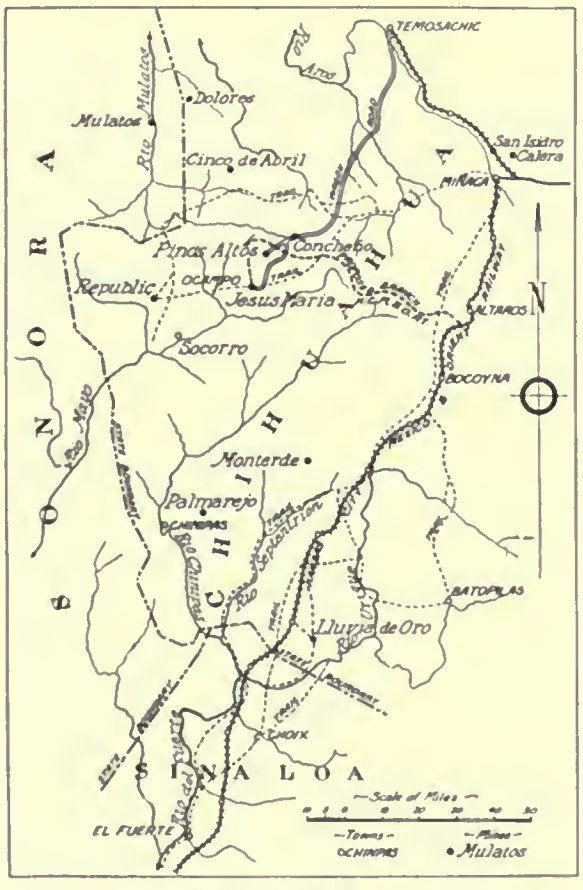
The San Toy mines, in the Santa Eulalia district, have increased their ore shipments from 200 to 400 tons per day to the Torreon smelter. The mines comprise the Galdeana and Juarez. L. A. Dockery of Chihuahua is mine superintendent, and J. P. Hutchinson is general manager.——The Encinillas Mines Co. is the owner of the smelting plant at Santa Rosalie. The company has acquired some mining properties in the Sta. Eulalia district, one of which is developed. Some new equipment has been added to the plant and it is announced that the furnaces are to be blown in soon. H. Thofern represents the French and English stockholders who control the concern. R. J. Morambert, formerly with the A. S. & R. Co., is superintendent.

The Sierra Mojada mines in Coahuila are producing about 8000 tons of ore per month, which is 2000 tons less than was being produced six months ago. The principal mines are those of the Cia. Minera La Constancia, managed by W. Hageman; those of the A. S. & R. Co., managed by W. B. Gates; those of the Cia. Metalurgica Mexicana, under the management of G. H. Carnahan. The Constancia ores are shipped to the smelter at Torreon, those of the Mexicana to its own smelter at San Luis Potosi. The ores of the Mojada district are of two classes: A lead-iron ore averaging 400 gm. silver per ton, 12% lead, 35% iron, and 20% silica; and a lime ore, carrying 800 gm. silver, 2% copper, 30% lime, and 20% silica. The latter class makes a desirable ore for the copper furnaces. The lead-iron ores are obtained at 100 to 300 ft. depth, the lime-copper ore from 400 to 600 ft. The lead blanket has a decided dip and as its strike is followed there is a gain in depth. The lime-copper ore occurs in the lime near the contact with conglomerate.

The Almoloya mining district is five miles from Baca station, the latter being between Jimenez and Parral. Among the properties there is the Cigarrero mine, belonging to a Mexican company, which has been mining and shipping ore for the last four years. It is said the profits in that time have amounted to P5,000,000. The workings extend to 1000 ft., the ores being silver, lead, gold, and copper, mostly oxidized. Shipments are made to the Monterrey smelter. The equipment includes a 3-rail incline tram extending from the mine, on the mountain slope, down to the base of the hill to the bins.

This is 4000 ft. long. The ore is hauled to the Baca station over the company's four-mile line of railroad.—— The Mexican Mines Corporation of Chihuahua is developing the Placeres group in the Almoloya district, employing 40 men. The work has reached 220-ft. depth. W. D. Pearce is superintendent. The Cia. Minera de Almoloya, in developing the Iguana group, has shipped a good tonnage of ore. The shaft is now 500 ft. deep and the intention is to sink deeper in the hope of striking the Cigarrero vein on its dip toward the Iguana. The ores of Almoloya present a variety. Besides lead, silver, and copper in an oxidized condition, there is said to be considerable of copper and zinc carbonates.

The properties of the Dolores Mines Co. are at Mineral de Dolores, in the northwestern part of Chihuahua. The camp is reached by traveling 35 miles over a new trail westerly from Madera, the latter being on the railroad of the



Map of Part of Mexico.

Sierra Land & Lumber Co., which connects with the Chihuahua & Pacific railroad at Temosachic. The Dolores company maintains an agency at San Isidro, a town and post-office on the Chihuahua & Pacific railroad. These are the gold and silver mines, opened by a 550-ft. shaft and a 1200-ft. adit. The latter intersects the shaft at the 350-ft. station. The hoist, air-compressor, and mill are being operated by steam, but plans are made for installing electric generators having a capacity for all purposes. An interesting fact concerning the engines, boilers, mill equipment, air-compressor, and pumps is that they were all built sectionalized and transported to this camp on pack animals. The mill consists of 15 stamps, 3 Bryan mills, 2 tube-mills, 3 Wilfley tables, and 7 agitating vats. The stamps crush the ore in a weak cyanide solution. The tables make an iron and copper concentrate, which runs high in gold and silver. In this way most of the copper is taken out of the pulp that goes to the agitating vats. The re-grinding by the Bryan mills and tube-mills is such as to make a product 85% of which will pass a 200-mesh screen. After cyaniding in connection with agitation and decantation, the slime is passed to Butters filters for withdrawing the solution from the solid material. W. H. Paul, the general manager, states that the mill yields an extraction of 93 to 96%. The gold and silver in the ore are about equal in value, making an ore worth approximately $50 per ton. This company has extensive timber rights, and roads have been built into the well wooded tracts. Recent improvements include a sawmill and a telephone line to the railroad at Madera. The company employs 700 men.

The Benito Juarez Mines Co., of the City of Mexico, has acquired and consolidated 30 mining properties in the Peñon Blanco district of Zacatecas, situated 10 miles southeast of Salinas. These properties have been operated for years by Mexican owners and their record of production is excellent. About half of these are on one mineral zone and the rest on another, striking parallel to each other through a country of limestone shale. The ore carries chloride and bromide of silver, accompanied by gold, some of which is in free state. This applies only to the orebodies above the water-level, which is about 400 ft. below the surface. Below the water-level the metals occur as silver sulphide, with gold, associated with pyrite. In the oxidized portion the silver is of first importance, while in the sulphides the gold is dominant. The vein is from one to ten metres wide. The deepest shaft on the property is 425 ft., with a 70-ft. winze from the lowest level. The worked-out chambers on this and other mines of this group show the ore-shoots to have been of great width and continuity. On the lower levels where the ore was untouched by former operators the vein structure is apparent. To the 450-ft. level the vein appears of quite uniform width and between well-defined walls. This has reference to the property that is now the chief centre of operations. There are other shafts and adits along the strike of the mineral belt, with numerous dumps of ore of milling grade, affording some idea of the extent of the development carried on at an earlier period; in fact, there are four or five dumps on the group that contain an aggregate of about 30,000 tons of ore which will pay to mill. Since July 1, 1907, this company has shipped ore of the value of P100,000, the result of development work. In this manner the output is paying for exploration and a considerable amount of surface improvements. The ore designated as shipping ore is said to carry 43.8 gm. gold, 1275 gm. silver per ton, with 0.6% iron, 14.2% lime, 71.6% silica, giving a gross value of P103 per ton. The mill-ore contains 32.5 gm. gold, 518 gm. silver, 1% iron, 11.3% lime, 68.8% silica, having a gross value of P62 per ton. It is estimated that the mill-ore on the old dumps will average P18 per ton. A mill is to be built on the property, to have the capacity of over 100 tons per day. Plans have been made and the contract for supplying the machinery will be let before this is in print. It will comprise a crusher, 20 stamps, belt-conveyors, hydraulic sizers, Wilfley tables, tube-mill, and cyaniding equipment. It is proposed to use cyanide solution in the battery. The method proposed has been well tested in an old mill on one of the properties. The mill, air-compressors, hoisting machinery, and other equipment are to be operated by electric power, to be generated at Salinas station. The plans also contemplate the building of an aerial tramway to convey ore from the various mines to the mill. The officers of the Benito Juarez Mines Co. are as follows: A. B. Carpenter, president; John C. Brennon, general manager; Engle Carpenter, secretary; E. P. Ryan, engineer. Dr. Philip Marvel, of Atlantic City, N. J., and Geo. W. Coles, of Philadelphia, are among the stockholders. C. O. Lundberg has just been made general superintendent.

Concentrates.

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

IN sinking very dry shafts a little water let down in the form of a spray just after blasting will aid in ventilation.

HARD TIMES have not depressed the radium market, the latest quotations being $3000 for the thousandth part of a gram.

THE breaking of a winding rope while raising or lowering persons happens very rarely; since mining was resumed on the Rand in South Africa in 1901 there have been only two such occurrences.

THE best preventive of the spontaneous ignition of coal is a small cylinder of compressed carbon dioxide fitted with a fuse plug melting at 200° F. A cylinder 1 ft. long and 3 in. diam. would be sufficient to fill the pores of 8 tons of coal.

THE cost of producing blister copper at the Mount Lyell mine in Tasmania during the half-year ended Sept. 30, 1907, was $3.704 per ton of ore; this was 24.46c. higher than in the previous half-year. The ore treated averaged 2.32% copper, 1.72 oz. silver, and 0.045 oz. gold per ton.

THE cost of mining coal in Montana and Wyoming has been roughly estimated at $1.65 per short ton, distributed as follows: Inside labor, 45c.; outside labor, 17c.; driving gangways and entries, 63c.; supplies, 17c.; preparation, 8c.; general expenses, repairs, and insurance, 14 cents.

MUCH trouble is caused in brazing by not using thoroughly fused borax. Dry borax does not answer, as it swells while brazing and makes the joint porous. The borax should be melted in a clay or iron crucible to a clear liquid, so as to drive off all water. Such borax will not swell when used for brazing.

WHERE the practice of a mill is rolls and cyanidation, the coarse gold may be extracted by running the sand over Wilfley tables (200 tons to 16 tables) and then reconcentrating the product on four additional tables. The product from this can then be placed in a clean-up barrel and pan, where the gold becomes amalgamated.

THAT underground waters are not necessarily all of meteoric origin is now recognized by geologists. Some may arise from the squeezing out of occluded water from igneous magmas as they cool and contract, but it has not yet been proved that such waters are given out in sufficient quantity to feed thermal springs or to form ore deposits.

TWENTY-FIVE stamps each of 1400 lb. are being added to the mill at the Witwatersrand Deep mine in South Africa, to be used instead of tube-mills for fine grinding. The concentrate from the 220 stamps of the present plant is to be returned from the spitzluten and re-ground in the mortar-boxes of the new stamps, which will have very fine screens.

WORK done by a dredge, excavating gravel on a placer claim, satisfies the law as to assessment work as to the location upon which the work is done, but this class of work done upon one location cannot be credited to adjoining locations, nor can the cost of the dredge be considered in estimating the amount of assessment work on the group of claims.

IN the gold mines of Orenburg, in Russia, a great quantity of timber is used in the underground workings. Drifts, cross-cuts, and winzes are all closely timbered, even when the rock is quite sound and hard. Close timbering with square sets seems to be invariable in the stopes of the Russian mines. It appears that the Russian Mining Inspectors require timbering in all underground workings, regardless of the nature of the ground.

IN the measurement of alluvial deposits, a cubic yard of ordinary gravel is usually estimated to weigh 3000 lb. The value is stated in cents of free gold per cubic yard, and the result is determined per yard of measured dirt and per yard of space excavated. The gravel has rarely less than 30% nor more than 45% of voids. If the pebbles have an average specific gravity equal to that of quartz (about 2.60) a cubic yard of the gravel would weigh from 2408 to 3064 lb., depending on the percentage of voids.

THE law does not restrict the number of claims that may be located continuously on a lode by an individual, nor does it limit the number of placer locations that an individual or an association of persons may make. An individual may make as many 20-acre placer locations or as many lode locations as he sees fit, provided, of course, that he makes a discovery on each, and otherwise complies with the Federal or State laws. This is the uniform rule throughout all the States, so far as we are advised. There is an exception in Alaska, made by local rules, limiting the number of placer locations that a locator may take on a given creek or bench.

THE breaking load of the ordinary one-half inch wire hoisting-rope, composed of six strands, of 19 steel wires each, and a hemp centre, is from 7 to 8 tons, and the safe working load is about one ton. If there is more cable on the drum than is in use, it should lie perfectly even and smooth on the drum. To accomplish this, when attaching the cable, wooden clamps are often put on the cable, to tension it as it is wound on. As these clamps groove rapidly, making an uneven tension, a better plan is to run the loop of the cable down the shaft, and attach a weight there, which will give a uniform load as the rope is wound up. A loaded bucket of the size generally hoisted makes a good weight, and can be temporarily fastened to the cable with a clip. If the rope is not tightly and evenly wound, it will jump as it changes direction, at each side of the drum, causing an excessive strain on the cable, and increasing the wear.

AN UNUSUAL METHOD for determining the cross-section of a river having rapids in which a boat could not be held, has been used at the Wabegeshik chute on Vermillion river in Canada. A fine steel wire such as is used for binding armatures of electric motors was attached to a 25-lb. lead weight. The length of the wire was measured and a transit set upon the bank close to the water's edge. The weight was put into the water on the opposite side in line with the transit on the cross-section desired. The lead weight was pulled across the river-bottom by the transit-man. Readings of its position were taken as often as desired. The distance from the weight to the axis of the telescope was determined by deducting from the total length of the wire the portion back of the transit. The vertical angle of the wire was read by the transit-man sighting at the point where the wire cut the surface of the water. These readings were plotted to scale and the cross-section of the bottom of the river determined as accurately as was necessary for the purpose. This was accomplished without danger and at small expense.

Discussion.

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy.

History of Cyanidation.

The Editor:

Sir—In your issue of November 30 Mr. Philip Argall describes the Diehl process as practised at Kalgoorlie, and as I consider this account of the process to be somewhat misleading, I beg your permission, and the author's, to make a few remarks on the subject. In the first place, Mr. Argall states that the ore is crushed in batteries using dilute cyanide solution; also, inside and outside amalgamating plates are employed. As far as I am aware it is not at all desirable to use cyanide in the battery water, but in Kalgoorlie pure water is such an expensive item that it is found advisable to use the same liquid over and over again as much as possible; the return water contains cyanide and this must necessarily contaminate the fresh supply. With regard to amalgamating-plates inside the battery-boxes I may say that this is *not* the feature of the process, nor, as a matter of fact, do any of the batteries in West Australia that have big stamp-duties use inside plates. There are only two plants in W. A. that make use of the Diehl process, namely, the Lake View Consols and the Oroya-Brownhill, and in both of these the coarse crushing absolutely prohibits the use of inside plates. In addition to this, on the Lake View Consols there are no outside plates, the pulp going straight from the boxes to Wilfley tables. I am not certain if the same state of things obtains at the Brownhill, but I think it is so.

Mr. Argall says that the concentrates are roasted and amalgamated. This is quite right as far as it goes, but in actual practice the roasted concentrate is slimed in Wheeler pans into which quicksilver is fed, and the slime is agitated with straight cyanide, and filter-pressed.

I do not agree with Mr. Argall that the process is declining in Australia. It must be remembered that the only installations there are on the two mines mentioned, and each of these is a success. I know more about the Lake View Consols than about the Oroya-Brownhill, and can safely say that on the former property a most excellent extraction is obtained on $7 ore, and at quite a reasonable cost. The same applies to the Brownhill, but I have not the same personal knowledge of this mine as I have of the other.

F. PERCY ROLFE.

Keystone, Wyoming, December 17.

College Instructors.

The Editor:

Sir—A recent utterance of yours made at the dedication of the Hearst Memorial Mining Building at the University of California has opened a subject of vital importance. I refer particularly to your well-timed suggestion that instructors in the mining colleges should divide their time equally between teaching and practical work, each year of the one followed by a year of the other. I greatly desire to see more interest displayed in this question.

To one who understands the situation, and particularly to one who has viewed the matter from various points of view, the need of this arrangement appears so obvious that little remains to be said. Yet neither the great public, that court of last resort, nor the majority of our leading educators, appears to be thinking at all about it. An overgrown conservatism at times clogs the wheels of real progress. The greatest weaknesses in university training today are directly due to the lack of some such procedure as you have mentioned.

There are two definite and distinct reasons why instructors in technical schools need more actual contact with the everyday hard-working world. One of these is of strictly practical nature; the other possesses a moral aspect. And the former is not a whit more important than the latter.

Firstly, each instructor in engineering needs to study the application of scientific principles under the conditions obtaining in actual practice, that his class-room work may be in touch and infused with the real life of the profession. We have all had experience with the 'theoretical' man, the man who is always in trouble over the failure of his theories. Paradoxical as it may seem, the 'theoretical' man does not fail because of a superabundance of theory, but because of a lack of theory. In other words, he fails to grasp all the conditions under which he is laboring and therefore applies too few principles. And the typical college professor is the type of theoretical man. Why? Merely because he does not appreciate all the numerous details of actual practice. I have seen such a man, eminent in his own specialty, visit a reduction plant using the very methods upon which he is an authority, and make foolish statements and suggestions that would disgrace a hod-carrier. Yet he is not to be blamed. He is the result of an unintelligent educational system. Surely it is obvious that were men of this character to spend alternate years in actual work in the field, the grade of their college work would be raised far above its present level. What can we expect of our college graduates if they are always dependent for their instruction upon men who never comprehend actual living conditions in the larger world of labor? The students themselves feel this, with the result that much of their college work is skimmed over and a vast amount of training valuable in itself is cast aside as of little worth. On the other hand, if students feel that they are under men who do understand that which is outside the college doors, the quality of their work is vastly improved. In my senior year at college, while on a trip through the mines, I was greatly impressed, though not favorably, by the remarks of a young mining engineer who had graduated some years previously. His statement, almost verbatim, was this: "A college education is a nice thing to have and we are all glad we have had one, but when you get through, just take your education, fold it up, put it in your back pocket and forget it." This man was a superior student and a capable hard-working fellow who was apparently leaving no stone unturned in his attempts to achieve success. He stands as the commonest type of mining graduate one meets today. There is no need here for a discussion; these things are themselves all too eloquent of a lack of correlation between our colleges and everyday life. A university is truly a little world in itself, yet there must not be such lack of contact between it and the larger activities outside that each year's graduates are at first like children wandering in an unknown land, who long wonder of what good to them was their Alma Mater.

Secondly, instructors in technical schools need to keep in living touch with the work of their profession in the world, that they may realize fully what is needed there, and that their class-room work may have that inspiration which comes only from a real knowledge of human affairs. Of all the criticisms of higher education, I think the greatest is that the college graduates know so little of the real needs of humanity. The reason is not hard to find. The usual professor or instructor is all too ignorant of the deep throbbing life beyond college gates, with

its constant striving for higher things, both of matter and of the spirit. Our college graduates not only often lack adequate knowledge of the application of the principles underlying their profession, but fail in that essential test of the truly educated man, namely, good citizenship. Now of all times do we require educated men, men who can and will actively aid in building up a higher standard of social intercourse. This can be only when our university faculties are in touch and sympathy with the great current of human events. This applies to all departments of education, but particularly to the technical schools, for our young engineers possess vast potentialities for good in the world today. The race is advancing mentally, morally, and spiritually through its ever-strengthening grasp upon natural phemonena and laws, so that the men who deal professionally with these can do much to upbuild our social structure.

The whole matter can be summed up upon either a narrow or a broad plane. It may be said that if we desire our college-bred engineers to obtain during their undergraduate years the fullest possible knowledge of their profession, we must have men to teach them who know both theory and practice, who can elucidate all necessary principles and explain fully their application to the world's work. Such teachers can be had only by adopting some such method of procedure as you have suggested. Further, if one is not satisfied with the above narrow statement, as I am not, it can be put as follows: If our colleges and technical schools are to produce men characterized alike by thoroughness of training in their particular professions and a broad sympathetic insight into the social movements of the times, we must first have teachers who are true leaders in thought and action. To know books one must spend many quiet hours with them; to know the world one must be of it as well as in it.

The country is ever calling for *men*, and there be many who condemn our great public institutions of learning because they fail to produce many *men*. The country must learn that for *men* to be produced other *men* must be working to produce them. We must have instructors who know the world from actual contact and association with it. If more money is needed in order to get such a condition, let us have it; if more men are needed, let us find them. But in any case let us have our instructors with their fingers upon the pulse of struggling humankind.

JOHN A. REID.

Stockton, Cal., November 27.

Cornish Pumps of New Design.

The Editor:

Sir—In your issue of December 14 mention is made of Cornish pumps being used at the Berry United mine near Ballarat, in Victoria.

It may interest you to know that two double sets of these pumps were also installed in the Keystone shaft of the Loddon Valley Gold Fields Ltd., at Moorlort, in the same State, to pump, in two stages, from what was called the 500-ft. level of the mine.

The accompanying photograph clearly shows the construction of these pumps, and some departure from the usual form will be noticed. The flanges are the only flat surfaces in the design; and the old, square box-section clack chamber, which may have an excuse for its existence in smaller sizes, is discarded as being altogether unsuitable for a pump with 26-in. diam. plunger. The H construction is modified to bring separate parts of the pump into convenient weights and sizes for handling. The joints are all made with ½-in. diam. rubber insertion packing compressed into suitable recesses arranged in meeting faces. The valves are clearly shown, and are practically identical with the valves used by Henry Teague in 1863. The main valve ring is made of cast steel, the top valve of cast iron, the seat being of the common 'clack' design.

The Y on the top of the discharge-valve chamber is fitted with a snifter 6-in. diam. and the branch is to carry an air-chamber. This is charged by means of an apparatus of simplest automatic operation, and the desired water-level in each chamber, determined by observation, is maintained by means of a small escape pipe connected between the air-chamber and the discharge-pipe line. When the air-chambers were to be installed one of the 'old timers' was surprised and disgusted at the willful waste of money. "And what's the good of air-chambers anyhow? They're no good. Why? I never saw one on a Cornish pump in all my life!"

These pumps were built by the Austral-Otis Engineering Co. of Melbourne, from designs by the writer, at that time mechanical engineer for Bewick, Moreing & Co. in Victoria. The plungers are 26-in. diam. with stroke of 10 ft. and at a speed of 8 rev. per min. of crank-shaft; the plunger displacement is 3,175,000 gal. per 24 hr.; or assuming a slip of 10%, which is probably excessive, the net delivery would be 2,857,000 gal. per 24 hours.

A Cornish pump plant of large capacity should give a total combined efficiency of about 80%; this being taken from the throttle valve of the engine to the water-delivery. Cornish pumps of much less capacity cannot be expected to afford equal efficiencies. An electrically driven turbine pump-plant, comprising steam generating apparatus, can hardly be expected to give a total combined efficiency of more than about 45%. The application of electrically driven pumps has had some encouragement during the past few years and some of them may be showing satisfactory results. Such plants are usually more attractive than the cumbersome and expensive Cornish pump. The saving of expense by installation of the cheaper plant may be fully warranted when the life service of the plant falls within the time limit set by the angular contact of the two lines on a diagram of costs representing the combined first costs, running expenses, interest, etc., appropriate to the respective efficiencies.

E. P. JONES.

San Francisco, January 4.

A Difficult Bit of Geology.

The Editor:

Sir—A few years ago, while in Mexico, my attention was called to what was represented as being a very large body of low-grade gold ore, sufficiently rich to be made profitable, if equipped with such a plant as the amount of ore seemed to justify.

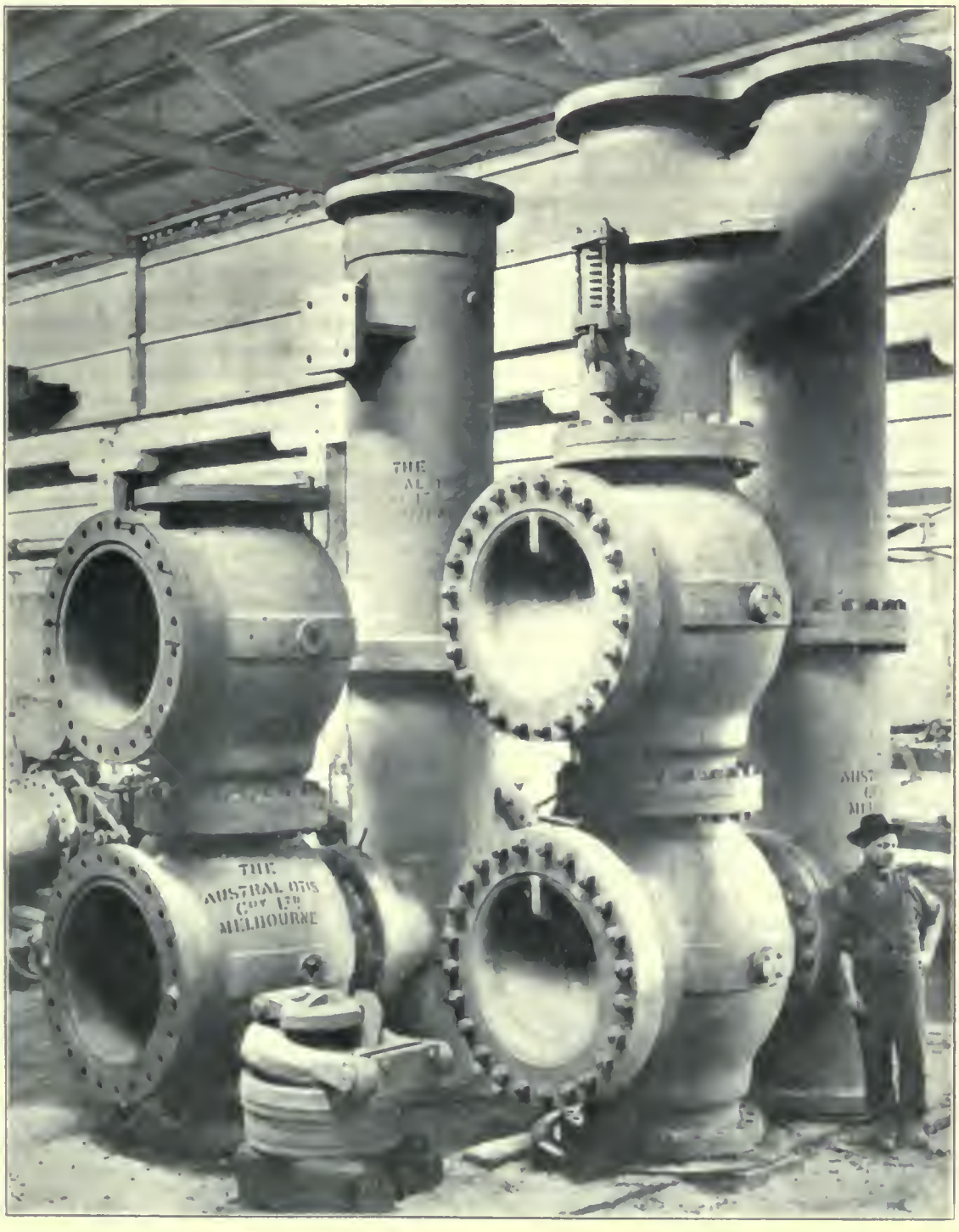
My informant was a well educated man, a graduate of Yale, a man who had traveled extensively, of some experience in mining matters, who had assisted in an examination and sampling of the mine in question, and I could believe had no object in trying to mislead me. A few weeks later, while in Culiacan, Sinaloa, I met a man from the immediate vicinity of this property, who, in answer to my inquiry, spoke well of it as a matter of casual observation, and at my request said that upon his return home he would again look at it and let me know whether or not it would justify a more careful examination. This man was an American of ordinary intelligence and education, of much experience as a miner and prospector, and, what is more, an honest man.

In a few days he wired me to come and see the mine,

which I did at once. I found the mine being worked by Mexicans, and that during the preceding month, as representing one month's work, they had cleaned up about $1800 in gold from one *arrastre*, run by the motive power of one burro; which was certainly an encouraging showing, so I entered upon an examination more than usually hopeful of a favorable result.

For a time the mine was quite a puzzle, which my preliminary work did not unravel, and I entered upon the work of sampling uncertain what was the form and nature of the mineralization. But in the study of such cross-sections as would best represent the value of the orebody, or bodies, as a mining proposition, and watching the work of the miners, it became less of a puzzle, until after some hours its true character became a certainty, and I said to my companion that I did not care to take more samples; that the property was all right for Mexicans to work in the way in which it was now being worked; but that as a mining proposition, for commercial profit on any considerable development and investment, it was valueless.

A description and explanation of the geology of the mine will perhaps make plain my reasons for this conclusion, and be instructive to some one who might have a similar puzzle to work out. The mine, or ore deposit, occurs at the valley terminal of a mountain spur which



Pumps for the Berry United Mine, Victoria.

in its uplift has intruded a fissure, which it probably caused, in a not very heavy andesite flow that covered the country, and which, while being a plastic porphyritic rock, was sufficiently rigid to not flow but lift the andesite as a blanket on its sides without shattering it except at the valley terminal, where it gave it a thrust. This shattering created gashes or fissures, which permitted of a rapid cooling of the hot plastic underlying porphyry, and consequently a gashing coinciding in a measure with the overlying andesite gashing. The unbroken edge of the

andesite lying as a blanket on the sides of the mountain-spur formed a trough, in which the drainage from the central porphyry apex percolated down to the valley terminal, gathering the minute quantities of gold from the disintegrating rocks and precipitating them in these comparatively colder, because more exposed, gashes above described.

These numerous gashes on, or around the end of the mountain-spur, all mineralized, gave the deceptive appearance of a mountain of ore, and might easily mislead. Indeed, I subsequently learned that some 15 years prior to my examination a Chicago company had spent something like $100,000 in building and putting in operation a mill, only to shut down after two weeks' run for the want of ore of sufficient value to pay; all the ground between the gashes proving valueless. Had they spent $5000 in proving the mine before building a mill they would have saved themselves $95,000. A gash vein is not unusual and is generally easily recognized; but a system of such veins so closely related is unusual, and might deceive an inexperienced man.

JOHN M. HENTON.

Rhyolite, Nev., December 17.

A Suggestion.

The Editor:

Sir—Without disparaging the excellent work done by the corps of geologists maintained in the field by the U. S. Geological Survey, there is undoubtedly much justice in your criticism that geological reports partake largely of the nature of obituaries. The methods of the Survey do not seem to favor real pioneer work. There is more or less work about affording guidance to the prospector, but as it works out in the field it is rather the prospector who guides the geologist.

Now, would it not be economy all around, instead of paying the professional geologist for collecting data largely furnished gratis by mining men and prospectors, to pay the properly equipped prospector himself under certain conditions for reporting on territory which he explores. A fraction of the liberal salaries which permit young geologists to acquire experience in the Government service would grubstake a goodly number of first-class prospectors and probably lead to the discovery of new mineral districts. Probably many young members of the Survey would prefer a grubstake and the chance of doing something on their own account to an assured salary. It appears some such plan might be worked out that would stimulate prospecting, make better geologists, and develop a spirit of independence where it seems to be greatly needed—among our educated men.

MUSHER.

Ketchikan, Alaska, December 17.

Cobalt.

The Editor:

Sir—In your issue of December 28, there is an article written by myself on Cobalt. In this article I state: "Up to the beginning of the present year, about 12,000,000 oz. silver valued at about $7,500,000 have been sold." This is an error. I should have stated that the production to January 1907, was about 9,000,000 oz. valued at about $5,500,000. Kindly correct this.

The amount of ore sold for 1907 is nearly 15,000 tons, containing probably 10,000,000 oz. or more of silver. This does not take into consideration low-grade ore of, say, 60 oz. or less. Three concentrating plants are in operation on the Coniagas, McKinley-Darragh, and Cobalt Central. Two large public concentrating plants are being erected, one on the Nipissing, using dry concentration, and another called the Muggley concentrator. Various mining companies are contemplating installing concentrators. These, as well as the ore at present sold, should largely increase the production for the present year.

FRANK C. LORING.

Toronto, January 4.

BORAX IN CALIFORNIA.—San Bernardino, Inyo, and Ventura counties in California yield all the borax produced in the United States. The total output of crude borax for the year 1906 was 58,173 short tons, valued at $1,182,410. This was an increase over 1905 of 11,839 short tons in quantity and $163,256 in value. The most productive mine was that of the Pacific Coast Borax Co. near Marion, in San Bernardino county. The workings extend to a depth of about 600 ft. in veins of colemanite. However, about the close of 1906, the mine was abandoned and the entire force of 200 men was transferred to the Lila C mine in Inyo county. The Western Mineral Co., near Daggett, produced a small output by dissolving its material and evaporating to dryness in solar vats, yielding boric acid. The American Borax Co. at the same place mined a low-grade deposit and produced boric acid concentrate which was refined at New Brighton, Pa. In Inyo county, the Western Borax Co. is working 'marsh mud;' this is concentrated by boiling and the solution is then crystallized. Near Griffin, in Ventura county, colemanite is mined by the Frazier Borate Mining Co.; it is refined by the Stauffer Chemical Co., at San Francisco. The Lila C mine in the Death Valley region is expected to be the heaviest producer of borax in the State for several years. The deposit is a colemanite vein known to be about 2000 ft. long and from 6 to 18 ft. wide. It is a high-grade ore, that shipped in 1907 having a boric acid content of about 40%. The production is expected to be at the rate of 30,000 short tons annually. This will be shipped to the Pacific Coast Borax Co.'s refinery at Bayonne, New Jersey.

COPPER IN NEWFOUNDLAND.—The copper deposits of Newfoundland occur on the shores of Notre Dame bay, on the east side of the island. They are more properly designated as pyrite deposits; they derive their chief value from the fact that they are useful in acid-making. The Tilt Cove deposit, belonging to the Cape Copper Co., and the Pillys Island deposit are the only ones that are being worked. They are thick lenticular orebodies of cupriferous pyrite inclosed in tilted bands of slates with interstratified dolomites, serpentines, and diorites. Three orebodies are known as Tilt Cove. The old or East mine was opened on an orebody 200 by 300 by 120 ft., wedging at a depth of 120 ft. Another is from 22 to 35 ft. thick. The ore consists of pyrite with close-grained yellow chalcopyrite; it carries 4% copper and 1½ dwt. gold per ton. The Tilt Cove company mined 54,253 tons of ore in 1902. It carried 3.3% copper and yielded a net profit of $239,540. In April, 1905, the East mine yielded 1860 tons of ore averaging 3.25% copper and the South lode, 1977 tons, averaging 3.75% copper.

DAMAGE SUITS.—According to a decision just handed down by the Supreme Court of the United States suits cannot be brought in the United States Court, or in any State court of the United States, against the Mexican Central Railway Co., Ltd., for injuries received in Mexico, although the injured parties may be citizens of the United States. The decision disposes of 25 cases which have been pending on appeal. The decision is based upon the dissimilarity of the laws of Texas and Mexico, and the Supreme Court refuses to enforce the Texas law, although both the defendant company and the plaintiff come directly within the jurisdiction of the United States.

Copper Smelting in Tennessee.

Written for the MINING AND SCIENTIFIC PRESS
By J. PARKE CHANNING.

During the early part of 1907 the continued shortage of labor in the South prevented any material increase in the production of the tonnage treated from the mines of the Tennessee Copper Co., and the depression in the price of copper in the latter part of the year of course discouraged any increase at that time. Although the labor situation has materially improved, this condition of affairs still exists.

The production is in the neighborhood of 12,500,000 lb. per year, though the mines, railway, and smelter have been so equipped that, if conditions demanded, the production could readily be increased to 20,000,000 lb. per year. At the principal mine of the company, the Burra Burra, the 2½-ton skips have been replaced by 5-ton skips, and the steam-pressure on the hoisting engine raised proportionately, it previously having been reduced from boiler pressure before entering the cylinders. This idea was held in view in the original equipment of the property and has worked out with remarkable success.

For handling the men, cages similar to those used at the Quincy mine, on Lake Superior, have been introduced. The shortage of labor has prevented much development work during the year, but this has now been taken up again and the shafts at the various mines will be sunk during the coming winter. An order has been placed with the Bucyrus company for a special type of dipper-shovel operated by compressed air and this will be installed underground on one of the Burra Burra levels for the purpose of loading ore from the underhand stopes into the mine cars. It is hoped that this will produce a material saving in the cost of loading and will also solve to a very large extent the difficult problem of securing the common labor necessary for this very important part of mine operations.

On the railway, a large number of cars have been rebuilt and one new 100,000-lb. locomotive added to the motive power. At the smelter an immense improvement has been made in the metallurgical operations, due very largely to increased mechanical efficiency of the charging system and the slag disposal system. Heavier locomotives and larger and stronger cars have been introduced. Heavier rails have been installed, so that delays from derailments have been practically overcome. It has also been found that the tuyere area of the furnaces was too small to permit of proper punching of the crust inside the blast-furnace. However, by paying particular attention to this point and keeping the tuyeres well open, the volume of blast has been materially increased, with a consequent better running of the furnaces; in fact, four furnaces at the end of the year are handling as much ore as six furnaces at the beginning of the year. It is intended to enlarge the tuyere openings by making out of each pair of tuyeres a long slotted tuyere, and it is hoped that the tonnage of the furnace will be still more increased. The larger volume of air, curiously enough, has resulted in an increased amount of FeO in the slag and a consequent reduction in the amount of silica necessary or else by an increase in the grade of the matte. During the early part of the year the first matte went about 10% copper. At present it seldom runs below 19%, and at times with a new furnace and the tuyeres well open, a 30% matte has been made continuously for 18 hours. There is a possibility that in time the second or concentrating operation may be entirely eliminated, though it is still too early to predict such a radical change. Now that the problem of making sulphuric acid is of as great importance as the production of matte, it is necessary to consider the volume of air blown into the furnace. Still, indications point to the probability that all air within reasonable amounts blown into the furnace combines with either the carbon of the coke or the sulphur and iron of the ore.

In the converting department the only change has been in the final determination to abandon the re-smelting of converter-slag and the pouring of that portion which is fluid into the settlers. This has been a much mooted question, but at Tennessee it has been definitely proven that unquestionably the commercial gains are far in excess of any possible metallurgical loss. The converter-floor is kept remarkably clean by pouring the last dregs of melted material from the converter ladles into small hand-pots, which are then run out and dumped. The skull in the ladle is dumped on the floor, breaks into pieces, and is not cemented together by the usual small amount of slag left in the ladle under old conditions.

The sulphuric acid plant has just been completed and at the present time the gases are going through it, and such minor adjustments are being made as are necessary in any plant of this size. Sufficient progress has, however, been made to show that without doubt the process will be a success. It is found that the proper grade of gas may be obtained by an adjustment of the various dampers. It is still too early to go into the details of the process, but it is hoped that later on a careful technical description of the results achieved will be given out.

CERRO DE PASCO.—It was five years ago July 9, 1907, that American engineers were sent to Peru to examine the Cerro de Pasco mines for the Hearst Estate and J. B. Haggin, as a result of which these two interests purchased the property. During these 5½ years a total of $17,500,000 has been expended in the purchase and development of this property to the producing stage, as follows: For the mines, $7,000,000; smelter, $3,000,000; railroad, 120 miles, $2,500,000; development, $5,000,000; total, $17,500,000. R. H. Channing, formerly general manager for the Utah Consolidated Co., is now in charge of the Cerro de Pasco. Three or four furnaces of 250 tons capacity each are now in commission and 2,000,000 lb. blister copper per month is being shipped into the United States for refining. Most of this product is being refined by the American Smelting & Refining Co. at its Keyser plant in Baltimore and the product has subsequently found a market in Europe. Operating conditions at the Cerro de Pasco make the production of copper a matter of considerable difficulty, as the mines are 14,000 ft. above sea-level and the native labor is very incompetent; 6000 men are employed. There is a vast amount of ore in sight in the mines which averages about 10% copper in the Cerro de Pasco mines and 15% copper in the Morococha mines, also owned by this company. There are 75,000 tons of ore on the Cerro de Pasco dumps and 40,000 tons on the Morococha dumps which will average 15% copper. The ores are found within a district one mile wide and two miles in length and they carry sufficient gold and silver values to permit of cheap costs, notwithstanding the many disadvantages of operation. While probably the Cerro de Pasco has proved one of the most expensive copper propositions ever developed, the leading interests in the company express no fear that eventually they will get back their initial expenditure of $17,500,000. J. B. Haggin, one of the largest owners, is 87 years of age. He has been in mining enterprises all his life and is the guiding genius in this Peruvian enterprise.—*Boston News Bureau.*

California Minerals.

Written for the MINING AND SCIENTIFIC PRESS
By ARTHUR S. EAKLE.

More than three hundred definite mineral species are known to occur in California, and of these about ten per cent were discovered first in the State and described as new minerals. A brief description of these distinctively Californian minerals, with the date of discovery, may be of interest.

ARAGOTITE. A hydrocarbon compound found as bright yellow scales in the silicious dolomite of the New Almaden cinnabar mine. Discovered in 1872 and named for the astronomer, Arago. The mineral was subsequently found with cinnabar at the old Redington mine, at Knoxville, in Lake county.

BAKERITE. A hydrous boro-silicate of lime, $(Ca_8B_{16}Si_6O_{35} + 6H_2O)$. Found in white amorphous masses associated with colemanite and ulexite at the borax deposits near Daggett, in San Bernardino county. Discovered in 1903 and named for R. C. Baker, of Nutfield, Surrey, England.

BENITOITE. A titano-silicate of barium, $BaTiSi_3O_9$. Found in hexagonal crystals of a beautiful blue color, transparent and hard, near the headwaters of the San Benito river in San Benito county. Discovered in 1907 and named for the county. This is the latest find of a new mineral in the State, and it is important as a gem stone.

BOOTHITE. A hydrous copper sulphate, $CuSO_4 + 7H_2O$. Found in green crystals and powder intimately associated with chalcanthite in the Alma pyrite mine, at Leona Heights, in Alameda county. Discovered in 1903 and named for Edward Booth, of the University of California. It has been found since at Campo Seco.

CALAVERITE. A telluride of gold and silver (Au, Ag)Te_2. Found as pale bronze yellow masses in the old Stanislaus mine, Calaveras county, associated with other tellurium minerals. Discovered in 1868 and named for the county. It has been found in abundance later at Cripple Creek, Colorado.

COLEMANITE. A hydrous borate of lime, $Ca_2B_6O_{11} + 5H_2O$. Found as colorless and whitish monoclinic crystals in Death Valley, Inyo county. Discovered in 1882 and named for W. T. Coleman, of San Francisco. Found in greater abundance and beautiful crystals during the following year in the Calico district, San Bernardino county. Colemanite is an important mineral for the manufacture of borax.

CROSSITE. A silicate of alumina, iron, lime, magnesia, and soda, forming a soda-amphibole. Found in lath-shaped crystals of a dark blue color as a constituent of some crystalline schists north of Berkeley, in Contra Costa county. Discovered in 1894 and named for Whitman T. Cross, of the United States Geological Survey.

HANKSITE. A sulphato-carbonate of soda, $4Na_2SO_4$, Na_2CO_3. Found in good hexagonal crystals associated with borax at Borax lake, San Bernardino county. Discovered in 1885 and named for Henry G. Hanks, former State Mineralogist.

IDDINGSITE. A hydrous silicate of iron, lime, magnesia, and soda. Found as bronze and brownish-red crystals in some of the eruptive rocks at Carmel Bay, Monterey county. Discovered in 1893 and named for J. P. Iddings, of Chicago University. Observed subsequently as a constituent of rocks from other localities.

IONITE. A hydrocarbon found as a compact earthy brownish-yellow substance in the lignite of Ione valley, Amador county. Discovered in 1878 and named for the locality.

KNOXVILLITE. A hydrous basic sulphate of chromium, iron, and alumina. Found as greenish-yellow plates associated with redingtonite in the old Redington cinnabar mine, at Knoxville, Lake county. Discovered in 1888 and named for the locality.

LAWSONITE. A hydrous silicate of lime and alumina, $H_4CaAl_2Si_2O_{10}$. Found in good orthorhombic crystals and plates of a light bluish-gray color in the crystalline schists of the Tiburon peninsula, in Marin county. Discovered in 1895 and named for A. C. Lawson, of the University of California. Lawsonite has been observed subsequently as a constituent of glaucophane schists and gneisses in many other localities.

MARIPOSITE. A hydrous silicate of alumina, magnesia, potash, and chromium, forming one of the micas. Found as apple-green scales and flakes in the rocks of the Mariposa region. Long known as constituent of the crystalline schists of the Mother Lode region, but first described in 1867 and named for the Mariposa Estate.

MELONITE. A telluride of nickel, perhaps Ni_2Te_3. Found in reddish white granular and foliated particles in the Melones mine, Calaveras county. Discovered in 1867 and named for the mine. Probably exists also at Boulder, in Colorado.

METACINNABARITE. Black sulphide of mercury, HgS. Found in amorphous masses at the Redington cinnabar mine, at Knoxville, Lake county. Discovered in 1872 and named for its difference from cinnabar. Later found in good crystals at the original locality and at New Almaden, New Idria, and elsewhere.

NAPALITE. A hydrocarbon, C_3H_4. Found as a waxy bituminous substance of a dark reddish-brown color, associated with cinnabar at the Phœnix mine, in Napa county. Discovered in 1888 and named for the county.

NORTHUPITE. A double carbonate of soda and magnesia with sodium chloride $MgCO_3, Na_2CO_3, NaCl$. Found in small colorless to brownish octahedral crystals in the clay from a boring at Borax lake, San Bernardino county. Discovered in 1895 and named for C. H. Northup.

PARTZITE. A hydrous oxide of antimony mixed with other metallic oxides. Found in blackish-green to black masses in the Blind Springs district, Mono county. Discovered in 1865 and named for A. F. W. Partz. Partzite is not a well-defined mineral species.

PIRSSONITE. A hydrous double carbonate of lime and soda, $CaCO_3, Na_2CO_3, 2H_2O$. Found in good orthorhombic crystals, colorless and white, associated with northupite at Borax lake, in San Bernardino county. Discovered in 1896 and named for L. V. Pirsson of Yale University.

POSEPNYTE. A hydrocarbon, $C_{22}H_{36}O_4$. Found in plates and nodules of a dirty light green color, associated with cinnabar in the Great Western mine, Lake county. Discovered in 1877 and named for the geologist, F. Posepny.

REDINGTONITE. A hydrous sulphate of chrome, iron, and alumina. Found in finely fibrous and crystalline masses of a pale purple color, associated with knoxvillite at the Redington cinnabar mine, in Lake county. Discovered in 1888 and named for the mine.

ROSCOELITE. A silicate of vanadium, aluminum, and potassium, forming a vanadium mica. Found in micaceous masses and scales of a dark clove-brown to brownish-green color, intimately associated with gold, at Granite creek, near Coloma, in El Dorado county. Discovered in 1874 and named for Sir Henry E. Roscoe, of Manchester, England. The mineral was first called colomite. It was observed later near Sutter's mill and in the Magnolia district, Colorado.

SONOMAITE. A hydrous sulphate of magnesia and alumina $3MgSO_4Al_2(SO_4)_3 + 33H_2O$. Found as silky

colorless crystals near the geysers, Sonoma county. Discovered in 1876 and named for the county.

STIBIOFERRITE. An impure hydrous oxide of antimony and iron. Found as a brownish-yellow coating on stibnite in Santa Clara county. Discovered in 1873 and named stibioferrite from its composition. It is probably not a distinct species.

SULPHOHALITE. A sulphato-chloride of soda, $3Na_2SO_4$, $2NaCl$. Found as transparent isometric crystals of a greenish-yellow color, implanted on hanksite from Borax lake, San Bernardino county. Discovered in 1891 and named from its composition.

TYCHITE. A double carbonate of magnesia and soda with sulphate of soda, $2MgCO_3 2Na_2, CO_3, Na_2SO_4$. Found as small octahedral crystals among many northupite crystals from Borax lake, San Bernadino county. Discovered in 1905, and named from the Greek word for 'luck.'

Names have also been given to varieties of well-known species and to minerals which were supposed to be new. Thus:

BERNARDINITE. Supposed to be a new fossil resin from San Bernardino county, but proved later to be a fungous growth impregnated with resin. Discovered in 1879 and named for the county.

CALIFORNITE. A variety of vesuvianite found in very compact green masses, resembling jade; on the south fork of Indian creek, about 90 miles from Yreka, Siskiyou county. Discovered in 1903 and named from the State.

KUNZITE. A variety of spodumene, a lithia-alumina silicate. Found in transparent crystals and cleavage pieces of amathystine purple and magenta colors, in the tourmaline district of Pala, San Diego county. Discovered in 1903 and named for George F. Kunz of New York. The mineral is important as a beautiful gem stone.

PALACHEITE. Supposed to be a new hydrous sulphate of iron and magnesia, but proved later to be botryogen. Found in masses of loosely coherent crystals of a brick-red color in the Redington cinnabar mine, at Knoxville, Lake county. Discovered in 1903 and named for Charles Palache, of Harvard University.

TRAUTWINITE. Supposed to be a new silicate of chromium, iron, and calcium, but proved later to be an impure chrome garnet, uvarovite. Found as green coating on chromite in Monterey county. Discovered in 1873 and named for J. C. Trautwine.

A CHECK-OFF SYSTEM whereby it is possible at any time to determine the exact number of miners and other laborers underground is in use at some large mines. At the office there is a carefully designed check-board, large enough to be properly spaced with nails at equal distances, so that numbered checks can hang in order, and the check-clerk can quickly pick off any number from the board. Each employee receives a check when he reports for work and returns it to the office when the day's work is done. One advantage of a careful system of this sort is that no man can be injured by falls of roof or local explosions and be left in the mine without his absence being noted. This leads to a prompt investigation as to the cause of non-appearance of the miner and the sending to him of assistance. A notable feature in connection with some recent explosions in coal mines has been the inability of the officials to determine the number of men underground at the time of the explosion; the check-off system would have prevented this uncertainty. In coal mining, after the day's work has started the superintendent can closely figure how many tons of coal the mine will probably produce for the day, by looking over the board and noting the number of men underground.

The Prospector.

Enquiries sent to this department are answered free of charge, if submitted by subscribers who are not in arrears. The full name and post-office address of the sender must be given, otherwise no answer will be made. Those who are not subscribers must accompany their questions with a fee of $3 for each question. No assays are made.

J. W. S. sends Quartzite.

Dolomitic Limestone was sent by C. D. B., of Yreka California.

D. C. F., of Tonopah, Nev., sends Tripolite or Diatomaceous earth.

Specimens sent by H. C. A., of Wallace, Idaho, have not been received.

W. B. H., of San Francisco, sends specimens No. 1, 2, and 3 of Soda Rhyolite.

A specimen of specular Hematite in Epidote and Quartz was sent by A. H. F., of Argenta, Montana.

Black sand, consisting of Magnetite, Ilmenite, red Garnet, and Quartz grains was sent by J. P., of Eureka, Nevada.

Specimens sent by C. H. L., of Silver City, New Mexico, are: No. 1, Obsidian or Pitchstone; No. 2, Clay stained by Hematite.

The two specimens from R. R., of Hawthorne, Nev., are: No. 1, granitic rock stained by Chrysocolla; No. 2, veins of Chrysocolla and Malachite.

M. L. M., of San Juan, Porto Rico, sends: No. 2, Chalcocite, Bornite, Malachite, and Azurite in an olivine basalt; No. 3, Basalt; No. 4, altered basaltic rock.

The rocks received from J. R., of Coffee, Cal., are: No. 1, Talc-Schist; No. 2, green and brown Chlorite; No. 3, Serpentine; No. 4, Hornblende-Biotite-Andesite.

Specimens from Wonder, Nev., marked H. G. G., are: No. 29 and 30, probably mineralized Rhyolite or Andesite; No. 31, Andesite; No. 32, Biotite in Rhyolite; No. 33, Diorite.

Minerals from Beatty, Nev., marked A. J., are: No. 1, Chalcocite and Malachite; No. 2, Bornite, Chalcocite, and Malachite; No. 3 and 4, Chalcopyrite in granitic rock; No. 5, Chalcopyrite and Limonite; No. 6, Pyrite; No. 7, Schist.

C. H. B., of Jalisco, Mexico, sends: No. 1, Meta-Andesite; No. 2, Hornblende-Syenite; No. 3, Obsidian; No. 4, Andesite; No. 5, 6, 7, and 8, Metamorphics, mostly Quartzite; No. 9 and 10, Andesite; No. 11 and 12, Rhyolite; No. 13, Quartzite; No. 14, Meta-Andesite; No. 15, Rhyolite; No. 16 and 17, Andesite.

The rocks from Iron Mountain, Mich., marked J. H. H., are: No. 1, Mica-Schist; No. 2, Pyrite in Mica-Schist; No. 3, Slate; No. 4, Slate or Quartzite; No. 5, Chlorite-Schist; No. 6, Mica-Chlorite Schist; No. 7, Pyrite in Amphibolite; No. 8, Quartzite; No. 9, Quartzite; No. 10, Schist; No. 11, Talcose-Schist; No. 12, Chalcopyrite in Quartz; No. 13; Quartzite; No. 14, Chert; No. 15, Quartzite; No. 16, Amphibolite.

The samples from Joseph, Idaho, marked A, are: No. 1, specular Hematite; No. 2, Chalcopyrite; No. 3, Hornblende; No. 4, Tetrahedrite and Pyrite; No. 5, Calcite; No. 6, Magnetite in Diorite; No. 7, Basalt; No. 8, Gneiss; No. 9, Quartzite; No. 10, Magnetite; No. 11, Pyrite and Hematite; No. 12, Diorite; No. 13, Hematite; No. 14, Aplite; No. 15, Biotite-Gneiss; No. 16, Epidote; No. 17, Gneiss; No. 18, Diorite; No. 19, Magnetite; No. 20, Magnetite in rock; No. 21, Granite; No. 22, Diorite.

Copper Production.

From present indications the output of copper in the Territory of Arizona last year amounted to 260,250,000 lb. and that Territory took the first place in copper output in the United States. This is not due to any increase in its production, however, but is the result of the falling off of 120,000,000 lb. in the production at Butte.

We estimate the production of copper on the American continent in 1907, compared with 1906, as follows (in pounds):

	1907.	1906.
Arizona	260,250,000	284,000,000
Montana	240,000,000	350,000,000
Michigan	230,000,000	228,000,000
Utah	98,750,000	60,000,000
California	21,000,000	15,000,000
Other States	15,000,000	35,000,000
Mexico and Canada	150,000,000	200,000,000
Total production	1,015,000,000	1,172,000,000

We figure the production in Arizona in 1907, by camps and companies, as follows:

Camp.	Mine.	Production 1907.	Production 1906.
Bisbee	Copper Queen	88,000,000	96,481,904
	California & Arizona	39,550,000	47,164,000
Clifton-Morenci	Arizona Copper Co.	27,000,000	25,960,000
	Shannon Co.	14,200,000	11,964,000
	Detroit Co.	15,000,000	16,906,000
Globe	Old Dominion	36,000,000	34,400,000
Jerome	United Verde	33,000,000	38,000,000
Miscellaneous		7,500,000	10,000,000
Total		260,260,000	280,875,904

The above totals in each year include a certain amount of Nacozari and Greene Consolidated production treated by the Copper Queen and Old Dominion in the form of concentrates and used for fluxing purposes. Had it not been for the unsettled copper situation, which necessitated restriction of the 1907 output of copper in the Territory, Arizona would undoubtedly have reached the 300,000,000-lb. mark, whereas production fell off 20,000,000. There is now a smelting capacity in the Territory sufficient to output considerably in excess of 300,000,000 lb. per annum.

Utah has made a notable gain in copper production in 1907 by reason of developments in the Utah Copper Co., Boston Consolidated, and Cactus properties and the operation of the new Garfield smelter. That smelter is now equipped to output 6,000,000 lb. copper per month, largely by reason of the treatment of Utah copper and Boston Consolidated concentrate. This would indicate an output from this smelter alone of 72,000,000 lb. per annum. The other smelters in the State are now shut down or preparing to shut down, and this fact may have some bearing upon Utah copper production in the new year, although, with any improvement in copper prices, the Utah ores would probably be shipped outside of the State.

Increased copper production is to be expected from California during 1908 with the enlarged capacity of the Mammoth smelter, the new Balaklala smelter, 90% completed, the Mountain Copper Co. plant reconstructed, and the new Bully Hill smelter about ready to blow in. A production of about 50,000,000 lb. copper from California in 1908 is within reason. Nevada will also be a factor shortly, for the Ely camp will be productive by April. A production of 50,000,000 lb. from the State next year, however, is about the limit of expectations.—*Boston News Bureau.*

IN structural materials the total annual production of the State of California is now between seven and eight million dollars. There are included brick and pottery clays, portland cement, lime and limestone, asphaltum, macadam, rubble and concrete rocks, paving blocks, marble, granite, sandstone, serpentine, slate, glass, sand, and soapstone.

Decisions Relating to Mining.

Specially reported for the MINING AND SCIENTIFIC PRESS.

Where blasting was required to be done after the general work in the mine ceased, and where it was the custom, when one miner left his work before quitting time, for his asssistant to fire off his blast, it was held that such an assistant in firing the blast of his fellow miner was not a volunteer, and that in case of injury he was entitled to recover.

McHenry Coal Co. *v.* Render, (Ky.) 104 Southwest, 996, Nov., '07.

Proof that a mine was not properly ventilated, that the air was bad, and that an explosion of gas occurred, was held sufficient proof of negligence on the part of the mine operator.

McHenry Coal Co. *v.* Render, (Ky.) 104 South, 996, Nov., '07.

Where it appeared that a miner, by reason of an explosion of gas was thrown some distance down the entry and bruised and was severely burned, a verdict of $6,000 was held not excessive and such verdict could not be set aside on appeal because the evidence of the defendant indicated that there was no explosion of gas, but that the plaintiff was burned by a blast which he exploded.

McHenry Coal Co. *v.* Render, (Ky.) 104 Southwest, 996, Nov., '07.

The failure of the locator to discover oil and a failure to retain possession and prosecute the work, was held fatal to the validity of the location under the statute providing that the entry of petroleum lands should be governed by the law relating to placer claims.

New England Oil Co. *v.* Congdon, (Cal.) 92 Pac. 180, Oct., '07.

The mere posting of notice and marking boundaries on the ground will not exclude others from a peaceable entry where the first locator had made no discovery, and had not retained possession and prosecuted the work looking to a discovery.

New England Oil Co. *v.* Congdon, (Cal.) 92 Pac. 180, Oct., '07.

Where an oil claim was located and the boundaries marked, but no discovery was made, and a cabin was constructed without furniture, doors or windows, and no one lived in it, and a watchman was employed to watch the claim in connection with other lands, but no drilling or actually developed work was done nor any steps taken in that direction, the land was held subject to re-location.

New England Oil Co. *v.* Congdon, (Cal.) 92 Pac. 180, Oct., '07.

Where there was a mining district recorder whose place of business was publicly known, it was held essential to a valid record of a mining claim that the certificate of location be recorded with the district recorder, as well as with the county recorder.

Ford *v.* Campbell, (Nev.) 92 Pac. 206, Nov., '07.

A certificate of location of a mining claim describing it as situated about two miles from a certain town, was held not to constitute a substantial compliance with the statute requiring a description of the location of the claim with reference to some natural object or permanent monument.

Ford *v.* Campbell, (Nev.) 92 Pac. 206, Nov., '07.

The recording of the certificate of location of a mining claim is not an essential requisite to a valid location.

Ford *v.* Campbell, (Nev.) 92 Pac. 206, Nov., '07.

There is no presumption that subterranean rights under lode mining locations were considered and determined in an adverse suit in the absence of the record of such suit.

Lawson *v.* United States Co., 28 Superior Court Reporter 15, Oct., '07

The Copper River District, Alaska—II.

Written for the MINING AND SCIENTIFIC PRESS
By W. M. BREWER.

In my previous communication on this subject I discussed the transportation problem. In this I shall discuss briefly the geology and occurrences of mineral.

The Copper river itself flows in a southeasterly direction, and its chief tributary, the Chitina, flows soutwesterly, the confluence being some distance above the Abercrombie rapids. Both of these rivers are navigable for light-draught stern-wheel steamers, and during the summer of 1907 a steamer made the trip up the Copper river from Abercrombie rapids as far as Copper Centre, which is a telegraph station on the Valdez-Fairbanks trail about 120 miles from Valdez. The same steamer also made a trip up the Chitina from its mouth to the mouth of the Nizina, a few miles northeasterly from and above the mouth of the Lakina.

Up to the present time the only discoveries of copper ore made on the Copper river proper are located near Taral at a point above the Abercrombie rapids and on the route of the projected line of railroad under construction from Cordova. T. W. Blakney located several claims on which copper ore outcrops some three years ago, and has since been doing the necessary representation work with a view to having some of the claims opened up sufficiently to be able to ship ore whenever the railroad is completed to Taral. No other discoveries have been reported between this point and the Kotsina river, a branch of the Chitina, several miles distant from Taral to the northeast. The first locations made in this region are on Elliott creek, a branch of the Kotsina and apparently the western limit of the mineralized country known today as the Copper River copper country.

These occurrences of copper ore were fully described by W. C. Mendenhall and F. C. Schrader of the United States Geological Survey in their report published in 1903. Since then the holdings of the Hubbard-Elliott company, comprising all of the known occurrences of copper ore on Elliott creek, have been examined by several mining engineers. These locations, from the best information I can obtain, are situated about 21 miles in an air line from the mouth of the Kotsina river, which would in all probability be the nearest point that the line of a trunk railroad would reach; consequently, the owners of the property will have to make arrangements for transportation between it and the mouth of the Kotsina river. However, shipments from the mine need not be delayed until the railroad is built to that point, because ore can be shipped from there by steamer to the Abercrombie rapids, to which point it is fully expected that the main line of railroad will be constructed during 1908. Therefore, whenever the mining property is developed to a shipping stage and some system of transportation installed from Elliott creek to the mouth of the Kotsina river, ore can be shipped to the smelters outside.

Apparently the mineralized zone extends northeast from Elliott creek across the Kotsina, Kushkilina, Chockosna, Lakina, and Nizina rivers, and possibly beyond into British territory. Until detailed geological examinations have been completed of both the United States and British territory, the full extent of mineralized country in this portion of Alaska and the Yukon cannot be determined. One thing is certain that when we consider the known discoveries of copper ore in what is known as the Copper River district, as well as in the neighborhood of the headwaters of the White, Alsek, and Tanana rivers, the superficial area is very considerable, greater possibly than the area of nearly any other copper-producing region.

Of course, at present this entire country is made up of isolated camps, as for instance, the Hubbard-Elliott camp on Elliott creek, the Gray camp on the Kotsina, the McCarthy camp near the headwaters of the Kushkilina, the Lynch and Greer camps near the headwaters of the Lakina, the Bonanza camp near the headwaters of the Nizina river. While a large number of prospectors have been attracted to this country ever since 1898, when the Hubbard-Elliott party went in, yet the number has not been sufficient more than to scratch the ground in the immediate vicinity of the most accessible portions, these naturally being adjacent to the streams; but gradually prospectors are extending their explorations into the territory between the rivers; indeed, during 1907 the country lying between the headwaters of the Lakina river and the Bonanza mine, a distance of several miles, was partially prospected, and several locations of copper ore were staked. In some respects this region is an easy one to prospect, because the rock formation is well exposed, the 'timber line' being low, in fact, you rarely find any timber growing above the river valleys, and that is scrubby. Glaciers of considerable extent occur at the headwaters of all the rivers and the rock formation shows evidence that these glaciers are of much less extent today than they have been in the past. In fact, it would appear as though the glaciers of Alaska and the Yukon are gradually becoming smaller.

The geology in the vicinity of the headwaters of the Lakina river is not as complicated as it is nearer the coast. Generally speaking, I found that the summits of the mountains were usually made up of crystalline limestone and that this was underlain by greenstone, in which occurred intrusive masses and dikes of amygdaloidal diabase. Of course, the limestone has suffered severely from erosion, so that frequently it is merely found overlying the igneous rocks in patches. Copper ore is found occurring at and near the contact between the limestone and the greenstone, as well as in the greenstone itself. The character of this ore is bornite with some chalcocite and chalcopyrite carrying from 4 to 42% copper, and where any quantity of solid chalcocite is found the copper contents will reach 70%. Other occurrences of ore are those found in the amygdaloidal diabase. This ore is native copper, much of it occurring as lumps weighing from a few ounces to several pounds, while the rock itself is found to contain small particles of native copper scattered through it to such an extent that samples are found to assay from 0.5 to 3.6% per ton.

Because of the limited amount of work that has been performed, it is not possible to estimate the commercial value of any of the occurrences of ore at the headwaters of the Lakina river. It is perfectly safe to say that on several mineral claims the prospects promise to develop into valuable mines, because the work done shows that the orebodies can be traced on the surface for some distance, say, for five or six hundred feet, the width varying from a few inches to 3 or 4 ft. These conditions apply to the occurrences of ore in which bornite, chalcocite, and chalcopyrite predominate. As far as the occurrences of native copper are concerned, the indications are that these may be found to possess great extent, and my reason for making this statement is that I observed intrusive blankets or sheets of amygdaloidal diabase exposed by nature on the hanging-wall side for a vertical height of 100 ft. or a horizontal measurement of about 600 ft. This was in a coulée formed in the mountain-side by erosion, where the greenstone hanging-wall had been carried away, leaving the sheet of amygdaloidal diabase exposed for a width varying from 15 to 15 ft., but the thickness of this sheet or blanket had not been determined at any point. The strike of this body is nearly east and

west magnetic, its dip being 30° southerly. The lines of strike of other orebodies to which my attention was called in this region are usually about the same, but the dips are generally more nearly vertical, but inclining toward the south.

No thorough examination of this district of Alaska can possibly be made unless the entire season is devoted to such work, and then it may be found that too little time has been allowed to cover the ground, even from Elliott creek to the Bonanza mine, to say nothing of the White, Alsek, and Tanana districts.

The altitude of the river valleys varies from about 1000 ft., which is the elevation of the Copper River valley near the mouth of the Tonsina river, and 2800 or 3000 ft., which is the elevation of the Lakina valley near the headwaters of that river. The mountain ranges reach elevations from about 5000 ft., the summit of the Kushkilina range, to some 7000 or 8000 ft. at other summits, which are accessible for exploration, while of course Mt. McKinley, Wrangel, Hood, and Blackburn reach much greater altitudes.

The Production of Copper.

By L. C. Graton

*Of the 917,805,682 lb. copper produced in 1906 by the smelters, 15,132,562 lb. were derived from the re-treatment of materials which had been subjected to reduction in previous years—namely, old slags, tailings, furnace linings, and the cleanings from old smelter sites. Of the 404,496 tons of this material, a great part was slags and tailings; consequently of low grade and capable of treatment only because of metallurgical advances. The average yield from this old material was about 1.8%. The remainder of the smelter output, 902,673,130 lb. copper, was the yield from about 19,743,000 tons of ore, the average yield per ton being about 43 lb., or 2.15%. The 1,700,000 tons of ore mined and treated primarily for values other than copper, furnished a very considerable portion of the total copper production. If these ores are left out of consideration, the yield of the 18,000,000 tons of ore mined expressly for copper was close to 50 lb. per ton, or 2.5%. The native copper ores of Michigan, which in 1906 yielded only 1.26%, being excluded, the remaining copper ores of the country yielded an average of about 73 lb. per ton, or 3.65 per cent.

Copper ores yielded 271,197 oz. gold, and 15,880,870 oz. silver, according to mine reports for 1906. This is an average yield for the 18,000,000 tons of copper ores of about 0.015 oz. gold, and 0.882 oz. silver per ton. If the Michigan ores that do not carry silver, amounting to about 8,000,000 tons, are excluded from this calculation, the copper ores which actually contained precious metals yielded an average of about 0.027 oz. gold, and 1.588 oz. silver per ton.

Pyrite smelting, which has grown rapidly in recent years, owing not only to metallurgical advances, but to the marked increase in mining of pyritic copper ores, offers, because of its high requirement of silica flux, an advantageous method of treatment for these silicious gold and silver ores which require or permit smelting. Copper is thus fast replacing lead as a collector of the precious metals in the smelting of dry ores. In consequence, the gold and silver product of all domestic ores treated in copper smelters was considerably in excess of the yield from the copper ores alone. This product in 1906, according to data partially incomplete, was, gold, 484,000 oz.; silver, 21,110,000 oz. The 1,700,000 tons of ores other than copper ores which were smelted in copper furnaces furnished, by difference, about 213,000 oz. gold, and 5,226,000 oz. silver, an average of 0.125 oz. gold, and 3.07 oz. silver per ton—a decidedly higher average than that of the copper ores.

All this gold and silver was recovered as such only on electrolytic refining of the pig copper. A part of the output of the Morenci-Metcalf and Bisbee districts in Arizona, and of the Ducktown district of Tennessee, and small quantities from California, New Mexico, and Missouri are too low in precious metals to make the electrolytic refining of this copper profitable. With these exceptions, practically all the blister copper of the country, as well as a noteworthy portion (over 10%) of Lake copper, is subjected to this separation by electrolysis. In all, about 669,000,000 lb. domestic copper carrying gold and silver, and requiring electrolytic refining, were produced in 1906. Ores containing sufficient quantities of both copper and lead to be classed as copper-lead ores supplied 59,371 oz. gold and 6,815,678 oz. silver, according to reports from the mines. Practically all these ores were smelted in lead furnaces, and the greater part of the precious metals was recovered in lead bullion, copper being collected as matte and further treated in copper furnaces.

Copper mines in general do not fall in the class of "poor man's mines." Ordinarily the ore is not amenable to any simple method of reduction, and is of so low a grade as to preclude very extended hauls to existing reduction plants. Much money must first be spent in extensive development of the orebodies. The company must usually expect to build its own smelter or mill, and to operate on a large scale to achieve low cost of extraction. In consequence of these conditions, most of the important copper mines of the United States are in the hands of strong companies able to advance the capital required at the start.

In few other industries is the tendency toward centralization and combination better illustrated than among the copper-producing companies. Fully 720,000,000 lb. of the 1906 output was produced by four operators—the Amalgamated Copper Co., with its many allies and associates; the Calumet & Hecla Mining Co.; W. A. Clark; and Phelps, Dodge & Co. With the entrance into the producing ranks of the Utah Copper and Boston Consolidated companies, the Ely mines, and the Dairy Farm mines, and with the expected increase in production of the Cactus and Mammoth mines, this list of four companies will be augmented by the United States Smelting, Refining & Mining Co., the Guggenheim interests, and the Newhouse interests. Four of these seven concerns either maintain or are closely associated with selling agencies.

Production at the principal mines is on a truly enormous scale, with ore tonnage and copper output of individual mining units ranging up to more than 2,000,000 tons and 100,000,000 lb., respectively, with single milling plants of a daily capacity up to 8000 tons, and with smelting plants turning out annually 90,000,000 to 175,000,000 lb. copper each. To the magnitude of these operations almost as much as to the abundance of her natural resources does this country owe her pre-eminence as a copper producer, with a record of over half the world's production.

*Abstracted from 'Mineral Resources of the United States,' U. S. Geological Survey.

Detonators for exploding dynamite consist ordinarily of a mixture of mercury fulminate, and potassium nitrate or chlorate, placed in a copper capsule; when the cap is to be fired with a fuse, the fulminate is covered with shellac, collodion, thin copper foil, or paper, and the end of the capsule is left open to receive the end of the fuse.

Bureau of Mines.

A bill to establish, in the Department of the Interior, a Bureau of Mines, was introduced on January 6 before the House of Representatives by Mr. W. P. Englebright, of California. It reads:

SECTION 1. That there is hereby established in the Department of the Interior a bureau to be called the Bureau of Mines. The chief purpose of this bureau shall be: (1) The acquisition and diffusion among the people of useful information concerning the mine and quarry industries, and the more efficient and safer methods of extracting and using the mineral products of the United States, its territories and insular possessions, with a view to the betterment of these industries, the improvement of mine conditions, the prevention of accidents, lessening the waste of materials, the improvement of milling and reduction of ores and securing a wise conservation of the fuel and other mineral resources of the nation; and (2) the investigation of materials used in construction, fuels, metals, and other mineral materials belonging to, or for the use of, the Government of the United States and how these can be used most efficiently.

Sec. 2. The President is authorized to appoint, by and with the advice and consent of the Senate, a Director of said Bureau, who, under the Secretary of the Interior, shall be charged with carrying out the purposes and provisions of this Act, and who shall receive a salary of six thousand dollars per annum. The Director of said Bureau, with the approval of the Secretary of the Interior, shall appoint for service in the city of Washington or elsewhere, the necessary experts and regular employees; and by authority of the Secretary of the Interior, he may employ such additional temporary experts and assistants as may be found necessary for like service.

Sec. 3. The Director of said Bureau, with the approval of the Secretary of the Interior, shall establish a station for the investigation of explosives and other matters pertaining to mine accidents, and such additional testing stations, laboratories, and offices, and he shall conduct such inquiries and investigations as may be required in carrying out the provisions of this Act. In establishing said laboratories or testing stations or for use otherwise in carrying out the provisions of this Act, the Secretary of the Interior may accept from any State, territorial or municipal government or corporation or person, any site, building, equipment, or fund which he may deem it proper to accept; provided, such acceptance shall be reported to Congress, and shall not be considered as binding the Government of the United States beyond the appropriations made by Congress; and the President is authorized to transfer to the Department of the Interior, for use in carrying out the purposes of this Act, any grounds or buildings or equipment belonging to the Government, and which he finds unnecessary for other public uses.

Sec. 4. The Director of said Bureau shall conduct, free of charge, such tests or investigations as may be needed concerning the nature and most efficient methods of utilizing materials used in construction, fuels, metals, and other mineral materials belonging to or for the use of the Government of the United States, except that in cases of extended investigation for any other branch of the Government service the cost may be borne in part or wholly by said branch. He may also conduct for the authorities of any State, territory, insular possession, or municipality, corporation, or other party, at cost, under regulations to be prescribed by the Secretary of the Interior, similar tests or investigations, especially when these are connected with building or construction works involving public safety, the improvement of mine conditions, or prospecting on public lands. In conducting inquiries herein authorized, the Director and his authorized assistants are hereby given the same power and authority in connection with the collection of statistics and other information as that given the Director and employees of the Census Bureau.

Sec. 5. The said Bureau is further authorized to cooperate with other branches of the Government service, or with the authorities of any State, territory, insular possession, or municipality in investigations germane to the purposes of this Act, in such manner as to avoid unnecessary duplication of work or expenditure; and in this work either co-operating party is authorized to pay the expenses or salary, or both, of any employee of the other party during the continuance of such co-operation. All money received from other parties as deposits to cover the cost of work by this Bureau shall be covered into the Treasury of the United States as part of a special fund; and all moneys received as contributions toward co-operative work herein provided for shall be covered into such special fund. The moneys in this special fund are hereby appropriated and made available for such purposes until expended, as the Secretary of the Interior may direct, for the payment of the cost of such work or a share of this cost as per agreement, and for refunds to the contributors of amounts paid in by them in excess of the cost or their share of the same.

Sec. 6. In connection with the inquiries hereby authorized into the mine and quarry industries and the most efficient methods of utilizing mineral products in foreign countries, the consular officers of the United States, when directed by the Secretary of State, shall make for the use of this Bureau such special inquiries and reports bearing on these subjects as may be requested; and special examinations into such conditions may be made in foreign countries by the technical experts of this Bureau when in the opinion of the Secretary of the Interior the same may be necessary and proper.

Sec. 7. The President may appoint as members of a National Advisory Board for the investigations of this Bureau (1), the heads of such other bureaus of the Government as conduct extensive construction work or purchase extensive supplies for the Government, to be tested by this Bureau; and (2) other persons experienced and skilled in one or more of the several lines of experimentation or industry to which the work of this Bureau relates, as he may deem advisable. This Board shall submit to the President through the Secretary of the Interior once each year, or from time to time as occasion may require, recommendations concerning the work of the Government or the conditions in the country to which these investigations relate. The members of this Board shall serve without compensation, but shall be reimbursed for expenses incurred in attending its meetings or inspecting its work, as may be authorized by the Secretary of the Interior.

Sec. 8. The Director of said Bureau shall prepare and publish, in editions of sufficient size to meet the demands for the same: (1) Annual reports embracing an administrative statement, and a summary setting forth the nature and extent of mine operations and production, the nature, causes, and prevention of mine accidents, and other results of inquiries and investigations conducted under the provisions of this Act; (2) bulletins, circulars, and special reports, each embracing the results of inquiries or investigations into one or more of the subjects covered by the provisions of this Act; the same to be published and distributed free of charge, as promptly as possible, among the people interested in these industries.

Canadian Industrial Disputes Act.

Written for the MINING AND SCIENTIFIC PRESS
By FRANK A. ROSS.

While the Canadian Industrial Disputes Investigation Act of 1907, popularly known as the Lemieux Act, is in most respects as novel and prudent as President Eliot declares it to be, and although it deserves all the good things said of it in December *McClure's*, yet those of us that operate under it know that in some of its practical and unexpected effects it is very burdensome to the employer.

The crucial test of any statute comes with an attempt to enforce its penal clauses. If this fails with respect to all parties, then the statute itself becomes a dead letter; but if a penal clause is enforcible as to one party and not as to the other, then the statute instantly menaces the first party at the hands of the second, and this is precisely what happens in the case of the Lemieux Act. It is operative as to responsible employers but is practically inoperative as against irresponsible employees. President Eliot, himself, evidently saw this feature of the Act since, in his conclusions, he says that it is an interesting question how the penal clauses of the Act are to be enforced, although it would appear from the remarks following that he had reference more to legal procedure than to punishment. The Lemieux Act is premature. Admirably conceived, formulated with cold impartiality, its influence over the industrial world will be inversely proportional to the degree of immunity from prosecution which, in practice, the irresponsible employee will be found to enjoy. Stated another way, there is nothing in this Act that makes it practically possible to penalize men that own nothing and that are constantly changing their residences. There is nothing in its mandatory strike-clauses to frighten the nomadic miner, for every mine-manager knows that when he wishes to quit work, he simply quits and that is all there is to it. He has no need to 'strike' for he is full of plausible excuses, born of a cosmopolitan experience, and his 'inalienable rights' are strongly safeguarded.

All this was clearly illustrated during the late unpleasantness at Crow's Nest Pass and, only a few days ago, in the Boundary country of British Columbia. In the latter district, the practical effect of the Lemieux Act was to prevent all reference to wages by the managers, before shutting down the numerous copper mines and smelting plants in their charge. It had been rumored that the men would reject any proposal involving a return to the old scale notwithstanding that the miners of Butte, Montana, had already done so on November 1, in strict accordance with their agreements which were based upon eighteen-cent copper. The men of the Boundary claimed that they, themselves, had signed no such agreement, although it was well known that the Boundary scale depended entirely upon that of Butte and it was a matter of common belief that both hinged upon the price of copper.

By the terms of the Lemieux Act, therefore, had any attempt been made by the managers to close down their plants after a proposition to reduce had been rejected and before a Commission under the Act had heard all the evidence in the case, it would have laid each of the companies liable to a maximum fine of $1000 per day, and they were all thoroughly responsible. There was nothing to be done, therefore, except carefully to avoid all reference to wages and the companies, confronted by the alternative of indefinite delay incident to official investigation or of a complete shut-down pending efforts for better terms, chose the latter. Within a few hours, every wheel in the district had stopped, immense plants were boarded up and thousands of men, over-confident of their power, suddenly found themselves without employment.

The fate of the Boundary country made a deep impression upon the men of Rossland, for on November 26, by a referendum vote, they decided to accept the old scale and so announced their decision to the managers although the latter had made no move beyond intimating unofficially that under the scale then existing all work would stop on December 1. Fear of the Lemieux Act thus brought about two diametrically opposite results, in the one case paralyzing all business and in the other, a few miles away, adding to it, through a return of confidence and a removal of suspense.

But in the Similkameen division of British Columbia this same fear of consequences to responsible employers brought about still another condition of affairs for, all official discussion of wages being barred, the men of this section ignored the wise procedure of the Rossland miners and, relying upon the 30-day clause for another month of high pay, refused to return to the scale now made general by the Rossland vote and thereby imposed an unjust loss upon their employers whom they knew to be helpless, since a shut-down, as in the Boundary case, was inadvisable.

These examples, in contra-distinction to those cited by President Eliot, will serve to show the other side of the Lemieux Act; and while they certainly indicate a weakness somewhere it may be doubted whether the weakness lies in the Act itself rather than in the absence of complementary, or preparatory, legislation necessary to give the Act full force and effect.

With this possibility in mind, the Industrial Disputes Investigation Act of 1907 was, in the beginning of this article, characterized as premature. No one who has ever been party to a serious industrial dispute will hesitate to advocate legislation that will render organized labor equally responsible with its employers, legally and financially; nor will he for a moment doubt that what is most needed to complete the usefulness of the Act in question is another act, or series of acts, compelling organized labor to incorporate, to own property, to maintain a guarantee fund as indemnity against loss to the employer from ill advised or willful acts of employees or their accredited representatives. Stated otherwise, it is high time for politicians to cease dodging this issue and for irresponsible trade unions to perfect their organizations to such an extent that each individual member thereof may go into court with clean hands, equally responsible with his employer, in every way.

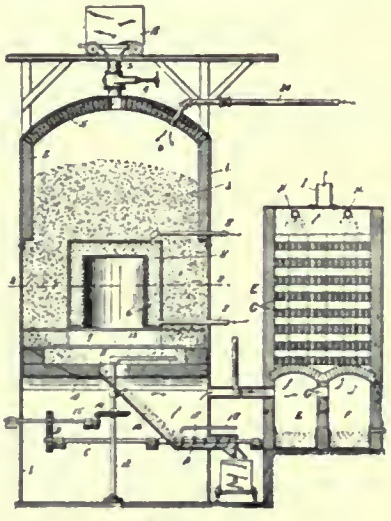
Nor is this at all impracticable or difficult. Combinations of labor are henceforth as inevitable as combinations of capital; but it must never be forgotten that, as the late John Marshall said: "It is not safe to trust to human cupidity when it has the opportunity to aggrandize itself at the expense of others."

To require labor organizations to incorporate, therefore, would result in immediate improvement in their internal discipline; and each member, being made to feel his personal responsibility in the acts of his representatives, would soon learn to chose his leaders for their business ability and integrity alone and not for oratorical powers or physical prowess. When this happens, as it must, and when labor leader meets business manager on an equal footing, each representing responsible interests and each capable of understanding the other, then will all industrial disputes begin to solve themselves almost automatically if held in check by laws as prudent and comprehensive as the Lemieux Act. But without this equality of legal and financial responsibility it is useless to pile statute on statute for, as Kipling says, it is only when the pocket book is touched that 'things happen.'

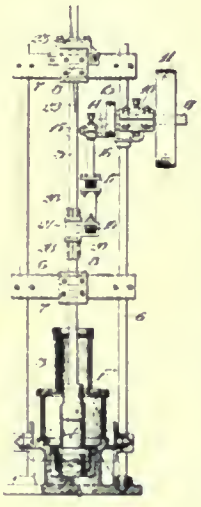
MINING AND METALLURGICAL PATENTS.

Specially Reported for the MINING AND SCIENTIFIC PRESS.

PROCESS OF CHLORIDIZING ORES.—No. 873,309; John E. Greenawalt, Denver, Colo.



No. 373,309



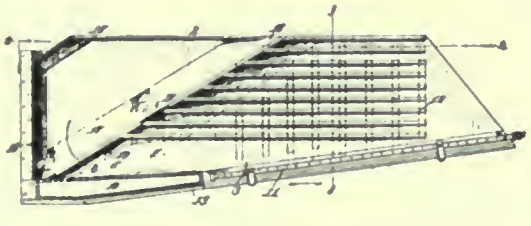
No. 873,323

The herein described chloridizing process which consists in introducing the heated ore into a chloridizing chamber, passing the ore through said chamber and into and through a cooling zone, and simultaneously passing a stream of chloridizing gas through the ore. A chloridizing process which consists of chloridizing the ore by means of sodium chloride by heating in a suitable furnace and then introducing the ore while still in the heated condition into a closed chamber and finally passing a stream of chloridizing gas through the ore.

STAMP-MILL.—No. 873,323; Francis I. Matthews, Oakland, Cal., assignor to Oakland Stamp Mill Co., Oakland, Cal., a Corporation.

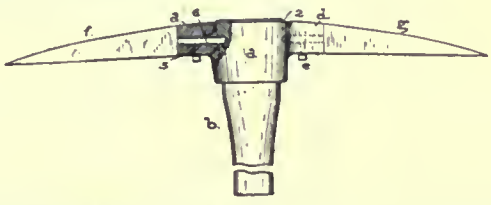
In an ore crushing mill of the character described, a guided rising and falling stamp stem, collars adjustably fixed upon the stem, a sleeve located between the collars through which the stem is loosely turnable, said sleeve having an offset horizontally channeled box, a segmental bow spring, a crank shaft and connection between the crank and the centre of said spring, links connected with the ends of the spring, a flexible yielding band extending between the said links and loosely through the channel of the box, a fixed guide, a transversely movable casing carried thereby, through which casing the stamp stem passes, a clutch mechanism carried by the casing, a spirally grooved sleeve fixed to the stamp stem, and corresponding lugs actuated by the clutch mechanism and engaging the grooved sleeve.

ORE-CONCENTRATOR.—No. 874,364; Ulysses S. James, Newark, N.J., assignor to James Ore Concentrator Co., a Corporation of New Jersey.



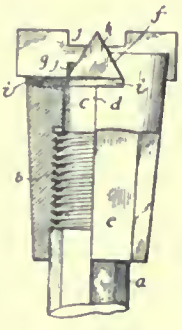
An endwise reciprocatory ore concentrating table having a concentrating portion flexibly joined along a line diagonal to the line of motion of the table and a slime portion, the concentrating portion being adapted to concentrate the pulp and the slime portion being adapted to receive the slime from the pulp and having an inclined ledge extending obliquely thereacross, provided with a face inclined upward toward the tail of the table and oblique to the line of motion thereof, combined with means for adjusting said concentrating portion angularly with respect to the slime portion.

MINER'S PROSPECTING TOOL.—No. 874,730; Dominik Bolderl, Oakland, California.

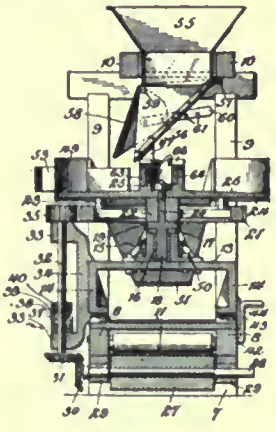


The herein described prospecting tool comprising a head having a tapering central socket, a handle removably fitted thereto and provided with cavities, and bosses on the head having squared ends, each boss being provided with a socket extending longitudinally from its end to the central socket, a detachable tool-point or member and a tang secured to the inner end of the tool and adapted to slide into a longitudinal socket, the tang being of a length greater than the socket and arranged to extend therethrough and into a cavity in the handle.

ROCK-DRILL.—No. 874,455; Frederick V. W. Swanton and Burt Price, Braamfontain, Johannesburg, Transvaal.



No. 874,455



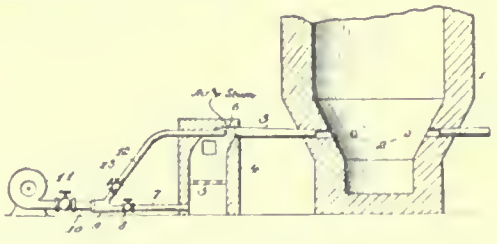
No. 873,748

In a rock-drill, a bit stock having undercut grooving on the face, triangular cutting means located in the grooved face and having an interlocking relation with each other and means for applying pressure to the underside of such cutting means to lock the same in position.

ORE-FEEDING MECHANISM.—No. 873,748.—Marshal Henderson, Doe Run., Mo., assignor of one-third to Ulysses Hawk, Doe Run, Missouri.

In feeding mechanism of the character set forth the combination with a downwardly and outwardly inclined table having a substantially upright axis of rotation, of a circular series of upstanding teeth carried by the central highest portion of the table, a vertically movable spout located above the table and engaged and operated by the teeth, and means for rotating the table.

METHOD OF SMELTING ORES.—No. 874,336; John C. Hardie, Helena, Montana.



A step in the reduction of a mass of ore in a chamber which consists in causing a direct blast of atmospheric air containing steam to enter directly into a gas generating chamber and to direct to the ore a carbon dioxide gas formed from the admixing in the upper portion of said generating chamber of a blast with a carbon monoxide gas formed by passing a blast of fluid containing air through an incandescent body of fuel.

A Mine Signal System.

The bell-line used for signaling in shafts is a crude affair; a miner is never absolutely sure, when signaling from a deep level, say the 1,000-ft., that the signal has been received as intended. Yet the bell-line must be retained for emergency use, for instance, for signaling from the cage, while inspecting the shaft or in case of accident, while men are on the cage; also in case the other system of signaling is temporarily damaged. But the method of rope-signaling is too slow and clumsy for even shallow shafts where fast hoisting is being done. In consequence, electric bell systems and electric flash systems of signaling are now generally used at mines. In some mines these are simply push-buttons and an electric switch in the lighting system of the mine to make and break the circuit.

These are too crude affairs for work in wet shafts, for water soon gets into the splicings of the wiring system and short-circuits result, with their attendant vexatious delays. Consequently, improved electric signaling systems combining the bell and the flash systems have been invented for this purpose. The Richmond Mine Signal System is one of these; it is used at the Ahmeek and the Mohawk mines in Keweenaw county, Michigan. At the Ahmeek mine the method of operation is by means of signal-boxes or semaphores in parallel throughout the mine, one signal-box being placed at every level or station from whence it is desired to signal. The depressing of a heavily constructed push-button, projecting from the front of the signal-box, operates the system. Through the construction of this push noticeable sparking is prevented. The signal-box contains a semaphore lens, a small electric lamp, and an audible signal; the whole is protected by a hood from wall-drippings and falling rock.

In the ore-house or on the dump there is a suitable bell which operates in unison with the signal underground and serves to notify the top-man that the skip is coming either with ore or waste rock. At the collar of the shaft there is also provision for a local circuit. The switch in this circuit operates a solenoid gong in the hoist-house, termed the 'surface gong.' The surface gong is controlled from the landing station as well as from the collar of the shaft. The mine system, distinct and separate from that of the surface, is necessary owing to the use of balanced skips.

The equipment consists of two semaphores, one on each side of the hoisting drum and in close proximity to the chalk marks on the rim of the drum. A relay switchboard for testing all lines is placed handy to the engineer's station. Suspended in front of him are the mine and surface gongs, which are operated by solenoids. At his hand is also a signal-box like that used underground; with this he can signal back when so desired. This ability to signal back to the underground operator is a great advantage. When the man below depresses the button, the call comes in at the hoist-house; the receiving mechanism then operates a relay and flashes back to the sender the identical signal that he has given. This is purely automatic and it is impossible to receive a back signal unless the call is received in the hoist-house. The underground operator watches his signal-box to see that his calls are correctly transmitted. In case of a mistake in pushing, he can instantly nullify the previous signal by a proper code. The engineer receives the signal from below in the following manner: With the pressing of the button on his signal-box by the man below, the relay in the engine-house energizes the solenoid gong, and sets a red light glowing in each semaphore on the rims of the drum. Releasing this button underground drops the plunger, puts out the red light, and causes a green light to take its place. This constitutes 'one bell.' The green lens shows the hoist-operator that all is in working order; the green light stays on until a call is given.

All signal-boxes on levels work in unison and show men on other levels when the system is in use and they govern themselves accordingly. The wires are placed in a specially prepared iron conduit, ¾-in diam., which protects the wires from water and abrasion. Three wires, not over No. 14 in size, are used.

At the Mohawk No. 5 shaft an improvement, designed by the inventor, consists of a small, compact, pocket telephone, which every mine captain and shift-boss carries in his pocket. This is about the size of a tobacco box. The telephone has a plug and cord attached. Every signal-box is provided with a hole underneath the box; by inserting the plug into this socket, connection is made with 'central' (the hoisting engineer); central can then, if it is desired, connect the underground system with the surface telephone lines; then the person underground can talk with any of the departments of the company at surface. The method of calling a man underground is through the engineer and his signal-box. All telephone troubles are confined to the telephone sets; another set can be issued while the broken one is being repaired.

The patent rights to this system are controlled by The Richmond Co., of Oshkosk, Wisconsin.

Commercial Paragraphs.

W. B. HAMMOND, 29 Broadway, New York, has succeded Herman Nieter as sales agent for the Hammond Iron Works of Warren, Pennsylvania.

ROBERT W. HUNT & Co., inspecting and consulting engineers, have established a branch office and chemical laboratory at St. Louis, Mo., under the charge of Charles W. Gennett, Jr.

THE ELSPASS ENGINEERING & MINING MACHINERY CO. of Denver, recently shipped a complete mill, including Elspass mill, Pierce amalgamators, boiler, engine, and full equipment to Round Mountain, Nevada.

THE AMERICAN MILL WORKS, of Aurora, Ill., have issued a new and attractive bulletin (No. 104), describing the construction of their centrifugal pumps and explaining the varied adaptations of this useful piece of machinery.

THE NEW YORK ENGINEERING CO. has recently secured a contract from F. B. Vrooman for a steam driven gold dredge to operate on the Hootalinqua river, in the Yukon Territory. This dredge will have a capacity of 2000 yards per day, and it is expected that it will be in operation by the early part of the summer. This company makes a specialty of building gold dredges, and has been successful in securing many contracts of late.

Catalogues Received.

THE INDIANAPOLIS SWITCH & FROG CO. of Springfield, Ohio, has issued a catalogue describing its manufactures which include crossings, frogs, switches, stands, and accessories.

THE DEISTER CONCENTRATOR CO., of Fort Wayne, Indiana, has issued a catalogue entitled 'The Deister Ore Concentrator No. 2.' The concentrator described is adapted for handling both fine and coarse feeds.

THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY issues the 'Catalogue' for December, 1907, containing lists of the officers and students, with a statement of the requirements for admission, and a description of the courses of instruction.

THE VULCAN IRON WORKS of Wilkes-Barre, Pa., has issued a well illustrated catalogue describing its elevating and conveying machinery and general colliery equipment, including hoisting engines, locomotives, boilers, hoisting crabs, cages, and screens.

CHALMERS & WILLIAMS of Chicago now have ready for distribution 'Section L' of their general catalogue. It describes the 'Gold and Silver Mill Machinery' which this firm manufactures, including the Kennedy gyratory crusher, overhead crawls, ore-bin gates, bucket elevators, and revolving screens.

THE special three-months course for mining men at the School of Mines of the University of Washington, at Seattle, begins this winter on Jan. 6. There are no charges for tuition, the only cost being for materials actually used and for books. The equipment in stamp-milling, concentrating, assaying, etc., is complete.

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Editorial.

ENGINEERING PROBLEMS are finding solution every day in mines, but it is rarely that a lucid account of them is forthcoming. To Mr. Henry Boursin we owe an excellent description of the manner in which a shaft was sunk through bad ground by resort to puddling. Only experienced mine superintendents can appreciate the nature of the difficulties overcome and the skill required for this uncertain work.

IRON AND STEEL MANUFACTURES exported from the United States in 1907 were worth close to 200 million dollars, as compared to 63 millions in 1897, and 16¼ millions in 1887. This affords an eloquent commentary on the growth of an "infant industry" under the kindly protection of a high tariff. Of the total exports of domestic merchandise, iron and steel manufactures formed 5.8 per cent in 1897, as against 10.8 per cent in 1907. Machinery constituted one-half of this class of export, the total value of machinery exported being $87,500,000.

PANAMA has gained vastly in importance by reason of the great waterway now under construction across the isthmus, and this Central American State has lately become of more interest to the world at large than at any period since the day when Balboa "stood lone upon a peak in Darien." The mineral resources of Panama are largely unexplored, mainly because transport is lacking in the interior, and the tropical vegetation makes prospecting almost impracticable. Any fresh information is welcome, and when it is conveyed in a plain straightforward manner, it is particularly desirable. For these reasons the article by Mr. Scott Turner should prove useful.

OUR DENVER CORRESPONDENT refers to the increased activity at Cripple Creek, and to the numerous new leases granted on mines in that district by reason of an influx of miners from Nevada and Utah. This is one manifestation of the fact that the depression in the prices of the base metals has tended to enhance the attractiveness of gold mining. Unquestionably a profitable gold mine is the most desirable of all enterprises today, for the owner of it can turn his product into coin by sending the metal to the nearest mint, so that he is independent of banks, and even of smelters, if his ore be docile to stamp-milling or cyanidation. He pays for his labor and supplies with the metallic product of the mine, and this product has a fixed value, in terms of the monetary unit, while being actually enhanced as relates to the amount of it exchanged in the purchases of labor or machinery required for the operation of the mine. We expect to see an intensified interest in gold mining,

and a notable stimulus given to the metallurgy of refractory gold ores. The hunger for gold is more acute today than at any time in human history.

CYANIDATION as applied to the silicious ores of Nevada is sure to gain in importance during the current year, therefore we are glad to publish the interesting and comprehensive letter of Mr. Lochiel M. King. He advocates dry crushing and roasting of the ore, instead of wet crushing and amalgamation, before cyanide treatment; and in support of his contention Mr. King quotes freely from a number of tests made on Goldfield ores. In regard to the presence of gold as a telluride, we are compelled to accept the evidence quoted by Mr. King, which is not necessarily contradictory to the statement of Mr. Edgar A. Collins; the first of these gentlemen refers to the Mohawk ore, while the second wrote concerning the ore produced from the Combination mine. This is not the first time that two neighboring ore deposits have exhibited an important difference in their mineralogical character. As to filters, it is noteworthy that the Merrill filter-press, so successful in the Homestake slime plant, is to be adopted in the new mill of the Goldfield Consolidated Mines Company.

Prospecting for a Meteorite.

IN the desert of northeastern Arizona, near the Canyon Diablo, a branch of the great gorge of the Colorado, there is a crater-like depression of mysterious origin. Travelers have invented explanations, and scientific men propounded theories explanatory of this curious hole. It is circular in form, nearly three-quarters of a mile in diameter at the top, about a quarter of a mile across at the bottom, and 600 feet deep. The country consists of horizontal strata of sandstone and limestone; on the border of the depression these rocks have been shattered, and the particles of quartz in the sandstone have been partly fused. The material ejected from this excavation lies scattered over the surrounding desert. Small masses of native iron have been found in the talus within the pit, and these have the appearance of meteoric fragments. Indeed, Mr. George P. Merrill, curator of the National Museum, made an investigation of the curious occurrence, and suggested that it may have originated from the impact of an immense meteorite. Others apparently shared this view, for a company was formed to prospect for a body of iron big enough to constitute a profitable mine. Holes were drilled through the floor of the pit and, after penetrating 600 feet of débris, the drill reached solid rock. No masses of iron were discovered. The enterprise collapsed, and the facts ascertained warrant a new theory. Another geologist, who has recently visited the locality, suggests that the depression is really what it appears at first sight to be, namely, a crater. It is true, no volcanic rock occurs adjacent, but this may be explained on the supposition that an explosion of steam blew out the rock and scattered the fragments over the neighboring country. The presence of sedimentary rock under the débris raises a difficulty, but it is suggested that the drill-holes necessarily explored only a small portion of the area underneath, and small passages may have existed by which the superheated steam reached a horizon at which the sudden relaxation of pressure led to a violent explosion. It is a significant fact that some of the strata at the rim of the crater are bent upward, indicating the action of force from below, instead of impact from above. While the meteorite story appears more wonderful than that of crater formation by the explosive force of superheated thermal waters, the latter would be quite as remarkable a manifestation of nature's unrest.

Professional Customs.

THE questions offered in good faith by a young mining engineer two months ago have now been answered by no less than 25 mining engineers of varied experience. Our young friend has got all the illumination he needs and if, in his future career, he errs in the special matters discussed, it will not be for lack of counselors. To some of the cynics the discussion may have seemed unnecessary, for the replies to the ten questions are fairly obvious. Nevertheless, a good deal of character is to be read between the lines and if most of the answers indicate a decided honesty of purpose, it is also significant that none of those whose methods are contrary to established rules, dared to avow them in print. The comparatively simple matters discussed may not appear of monumental importance, but we venture to hope that the consensus of professional opinions will be beneficial to the younger engineers. The older men are beyond the ductile stage and the best they can do is to train their sons to observe a code better than their own, for unless we advance, why move at all?

The three chief points touched upon in this discussion of professional customs have been (1) the nature of the agreement with the client, (2) the character of the expenditures to be debited, and (3) the nice question as to incidental personal speculation. It is not possible often to choose your client; the choice is usually on the other side. Engineers have to take business men and speculators much as they find them. Consequently, any man of experience can recall contracts that were broken and reports that were never paid for. But such mishaps are less common nowadays than they were twenty years ago; in part, by reason of the greater publicity incidental to dishonorable conduct and, in part, because of the larger amount of money spent in preliminary investigations. Whether a young engineer can get a definite agreement with his client or not, he can at least obtain an exchange of telegrams or letters, sufficient to constitute a contract. Two bits of advice may be offered in this connection; never undertake work for a personal friend without a definite agreement in writing, for a misunderstanding with a friend is worse than the loss of a fee; and, secondly, never make an arrangement with a director, as such; let it be with the individual or the company. If things go wrong, a weak man—not to mention a dishonorable one—will waive responsibility and pass it on to his com-

pany, and the other directors may repudiate the transaction. Therefore, either make the director personally responsible or else his company, with the proper endorsement of the officials empowered to act for the said company. By so doing, you may avoid the experience of falling between two stools. Of course, we could give the advice not to do business with the man you cannot trust, but that is putting the smell before the automobile; every client is presumed to be honest until proved otherwise. Backsight would be better than foresight, if it were not back-sight. So the advice must be modified by saying: Have nothing to do with people known to be tricky, as long as a client of a better class is available. But beggars cannot be choosers and if the only client on the horizon is a spoofer, get him to advance the amount of your expenses, at least, and exact some legal assurance for the fee itself. If he really wants your professional advice, he can be made to pay for it. Luckily, men themselves tricky often know enough to set a high value upon an honest opinion. So much for that.

Now, as to traveling expenses and incidentals. The question as to the propriety of traveling second-class and charging for first-class accommodations, may have seemed ingenuous, but it has the merit of going to the root of the matter. Of course, no engineer should charge a cent more than he spends and in traveling he should put his client to exactly the same expense as he would himself, if the journey were made on his own recognizances. Engineers travel first-class simply because time and health are alike conserved by so doing; moreover, as has been suggested, by traveling first-class they are apt to meet other people, such as fellow engineers, possessed of information useful for the purposes of the particular investigation or engineering work to be undertaken at the end of the journey. It is not necessary to itemize every petty expenditure, but an engineer should be prepared to give satisfaction as to the manner in which the client's money was spent. Many engineers count the money in their pockets when they start on a professional journey and count the balance remaining when they return, debiting their client with the difference. If careful note is made of any expense not properly debitable to the client, this method is fair, for the client should pay any costs arising from the incidents of the journey, that is, expenses not incurred by the engineer when at home. But such a net result ought to be checked by a statement, not only for the satisfaction of the client, but of the engineer himself. Customs differ in this matter and, naturally, much will depend upon the standing of the engineer and the importance of the work undertaken. Good sense, not to mention good judgment, is needed. A man who makes a fool of himself or proves tricky in these smaller affairs is not likely to win a reputation for integrity or trustworthiness. We know of an engineer who examined a mine in Australia recently and spent eight months of time, besides £10,000 in expenses, not including his fee, and yet the result of the work was deemed satisfactory to the company that footed the bills; but an untried man that had taken half as long and spent one-tenth of the money in expenses, would have been severely criticised, simply because such a performance on his part would have been difficult to justify. Be true to yourself, do not juggle with your sense of honor, and you are likely to conserve the interests of your employer.

This is particularly true of the next problem, namely, that relating to speculation in the shares of the mine you examine, the taking of options, and the acceptance of incidental engagements for other people when visiting a district for a specific client. To young men in doubt as to these points, we say, unhesitatingly: No. Go to a mining camp with a single purpose, accomplish it to the best of your ability, and return home to write your report. Listen not to the lure of the share market or the promptings of the promoter. Speculating in the shares of mines with which you are in any way connected is unprofessional, though professional men do it. An engineer ought no more to dabble in stocks than a broker. Both do it, but many wrongs cannot make a right. Whatever the ethics of the problem, there can be no question of the expediency as it affects young men. A seasoned man may take a glass of brandy after his dinner, a stripling is spoiling a perfect alimentary system by doing so. That way lies intoxication. To young engineers the stimulant of a share gamble is the most insidious peril that they face in the early years of their career. It has spoilt many fine fellows; it has ruined twenty times as many good engineers as it has enriched. And as to the taking of options and dealing in mines while under engagement to do a specific bit of work, that also is best eliminated from the program. It leads to complications, it may cause a division of duty, and at best it is no part of a young engineer's prerogative. A simple way of avoiding wrongdoing is never to do an act the correctness of which you yourself question. When you are young you will decide against yourself, if honorable; as men grow older their sense of nicety in such matters is apt to be dulled by contact with the business world, in which right and wrong are divided not by a line but by a debatable tract large enough for the manœuvres of a cavalry regiment. "But," says the alert young man who wants to be rich and successfu, deeming the two synonymous, "if I observe all these fine points of the game, I can never make money or utilize my opportunities." To which we reply that tricky, or self-seeking, or disloyal young engineers are soon rated at their proper worth—less than nothing—and that while some of them have been known to succeed in the winning of wealth, such instances are exceptional and in their final history are pitiable, while on the contrary most such men lose the confidence of their clients and usually change their occupation. Virtue may not always be rewarded and dishonesty may occasionally flaunt its winnings—it is not for us to sermonize—but it is not necessary to be a Methuselah to see that among a body of educated scientific men such as that of mining engineers and metallurgists, any success that involves loss of self-respect and the absence of goodwill from others is as a Dead Sea apple, as a sawdust doll, as grit between the teeth.

Personal.

MARK L. REQUA has gone to New York.

MARK R. LAMB is now at Guadalajara, Mexico.

FRANK R. SHORT is now at Carson City, Nevada.

R. H. ROBERTSON has returned from South Africa.

G A. DENNY is on his way from London to Mexico.

B. M. NEWCOMB, of San Francisco, is at Mexico City.

E. M. HAMILTON is now at the Butters Salvador mines.

T. H. JENKS is traveling in Sonora and Sinaloa, Mexico.

BENJAMIN T. LOEB has opened an office in the City of Mexico.

A. A. HEER is manager of the Little Florence mine at Goldfield.

EMILE R. ABADIE has an office in the Pacific Bdg., San Francisco.

BEN S. REVETT visited Goldfield on his way from San Francisco to Denver.

FRED. B. REECE is with the Homestake Mining Co., at Lead, South Dakota.

M. J. HENEY, of Seattle, the railroad builder of Alaska, is at the St. Francis hotel.

CHARLES G. YALE has ceased to be statistician to the California Mining Bureau.

GEORGE B. PUTNAM has returned to Pilares de Nacozari, Sonora, Mexico, from Denver.

CHARLES C. GATES is to be superintendent of the Giroux mines at Ely, Nevada.

J. B. HIGGINS, lately on the Simmer & Jack mine, at Johannesburg, is at Reno, Nevada.

H. DEC. RICHARDS has returned to San Francisco from Orleans Bar, in Siskiyou county.

ROBERT H. RICHARDS is paying a professional visit to Great Falls and Anaconda, Montana.

CURTIS H. LINDLEY has changed his office from the St. Mungo to the Mills Bdg., San Francisco.

WAGER BRADFORD, lately at Johannesburg, is here for a few days, preparatory to returning to South Africa.

T. L. GREENOUGH, on his return from Arizona, was in San Francisco, on his way to the west coast of Mexico.

HOWARD A. POILLON, recently superintendent of the McCracken Hill mines, in Arizona, is here for a few days.

J. C. NIVEN and LYTTLETON PRICE have opened an office as mining engineers in the Dooly Bdg., Salt Lake City.

W. ROWLAND COX has resigned as assistant general superintendent for the American Smelters Securities Co., in charge of mines in Mexico, in order to engage in private work.

S. H. BALL is in the Congo Free State. A party under his command had a big fight with natives lately on the concession near the Kasai river; more than a hundred of the attacking party were killed.

WILLARD S. MORSE, member of the executive committee of the American Smelting & Refining Co., has established headquarters at Salt Lake City, and is to have general supervision over all of the American smelting enterprises in Utah, Montana, and Nevada.

Obituary.

HENRY BURROW VERCOE died on December 17, 1907, at St. Leonards-on-Sea, Sussex, England, after a long and serious illness. He was the eldest son of the late Captain John Vercoe, of Bodmin, Cornwall, a well known mining engineer in the early days. For many years Mr. Vercoe was actively engaged in mining in various parts of the United Kingdom, and for twelve years prior to his retirement he had been heavily interested in gold and copper properties in California.

Latest Market Reports.

LOCAL METAL PRICES—Jan. 23.

Antimony	12@16c	Quicksilver (flask)	$45.50
Casting Copper	17¼@18½c	Spelter	6¼@ 7¼c
Pig Lead	3.85@ 4.80c	Tin	33@34½c

ANGLO-AMERICAN SHARES.

Cabled from London.

	Jan. 16. £. s. d.	Jan. 23. £. s. d.
Camp Bird	0 13 6	0 14 9
El Oro	1 2 6	1 1 3 ex div.
Esperanza	1 7 6	1 8 9
Dolores	1 5 0	1 7 6
Oroville Dredging	0 13 0	0 12 3 ex div.
Stratton's Independence	0 3 3	0 4 0
Tomboy	1 7 6	1 7 6

(By courtesy of W. P. Bonbright & Co., 24 Broad St., New York.)

SOUTHERN NEVADA STOCKS.

San Francisco, Jan. 23.

Atlanta	$ 40	Laguna	1.00
Belmont	78	Manhattan Con	22
Columbia Mtn	27	Midway	72
Combination Fraction	79	Mizpah Extension	.....
Daisy	1.22½	Mohawk	12.00
Fairview Eagle	55	Montana Tonopah	1.82½
Florence	4.90	Nevada Hills	3.10
Gold Bar (Bullfrog)	36	Red Top	.....
Goldfield Con	.....	Sandstorm	25
Goldfield of Nevada	5.80	Silver Pick	35
Gold Kewanas	55	St. Ives	53
Great Bend	21	Tonopah Extension	1.35
Jim Butler	37	Tonopah of Nevada	4.65
Jumbo	.....	Tramp Con	19
Jumbo Extension	57	West End	33

(By courtesy of W. C. Ralston, 353 Bush St.)

COPPER SHARES — BOSTON.

	Closing prices. Jan. 24.		Closing prices. Jan. 23.
Adventure	2¼	Michigan	12
Ahmeek	60	Mohawk	55
Allouez	31	Nevada Con	10¼
Amalgamated	49¼	North Butte	50⅝
Arcadian	5¼	Old Dominion	34½
Atlantic	13¼	Osceola	87
Balaklala	3⅛	Parrot	13½
Bingham Con	.....	Phœnix	1
Boston Con	14¾	Quincy	87
Butte Coalition	19	Raven	.....
Calumet & Arizona	112	Rhode Island	.....
Calumet & Hecla	655	Santa Fe	2¼
Centennial	26½	Shannon	12½
Con. Mercur	39	Superior & Pittsburg	14
Copper Range	62½	Tamarack	69
Daly-West	8¾	Trinity	15½
Franklin	9¼	United Copper com	6¾
Granby	90	Utah Copper	25⅛
Greene-Cananea, ctf	8½	Victoria	5
Isle Royale	24½	Winona	5¼
Mass	4	Wolverine	125

Commercial Paragraphs.

C. O. BARTLETT & SNOW Co., of Cleveland, Ohio, report increased inquiries and sales for their dryers and elevating machinery.

THE ALLIS-CHALMERS Co.'s Bulletin No. 2027, entitled 'The Hydro-electric Plant at Trinity River, California,' contains information on an interesting power transmission system. This plant is one of those which has been constructed with an eye to the future rather than the present needs of the communities which it serves. It is situated in the central part of Trinity county, California, two miles below the town of Junction City, where Canyon creek, from which the water used for power is obtained, flows into the Trinity river, having a drainage area of 52 square miles. The dam, which is small, serves merely for diverting the water. Alternating sections of ditch and open flumes, with a total length of 5250 ft. and a tunnel 1821 ft. long are comprised in the system. An effective head of 600 ft., or working pressure of 260 lb. per sq. in., is obtained from two penstocks, each 1165 ft. long. This power-house is equipped with Allis-Chalmers electrical machinery, consisting of two three-phase, 25 cycle generators, each 750 kw., 500 r.p.m., 2200 v., seven step-up transformers, and auxiliary apparatus. The description of the entire plant is quite complete and will be found of interest by engineers and students.

General Mining News.

ALASKA.

Many prospectors have outfitted to prospect next season for quartz veins in the Knik Arm region; heretofore this district has been prospected chiefly for placer mines.——The Ready Bullion Copper Co. has moved an air-compressor to its mine at Lynx creek and intends to drive an adit.——Last season Hatcher & Carne found several quartz veins at Willow Creek, about 25 miles north of Knik Arm. Some of the ore is said to carry $200 to $968 gold per ton; another vein that they intend to develop this year is said to carry $5 gold per ton.——Bartholf Bros. have found a vein of gold ore and expect to erect a small stamp-mill next summer.——It is said that James Girdwood secured 200 lb. gold at his placer mines on Crow creek near the Alaska Central railroad.——Late arrivals from the Cache Creek district, at the base of Mt. McKinley, report that a very rich pay-streak has been found on the south bench.——Fifty tons of Matanuska coal will be sledded to Knik Arm during the winter, for the purpose of a test by the Government.——Reports from Eagle River indicate that a promising lode has been found there. It has been developed by surface cuts at six places, all of which are said to have good ore.——Tailing dumped into the sea by the Topkok Ditch Co. has caused the water to recede so far that by sinking shafts from the top of the tailing pile it has been possible to get pay-gravel that formerly was beneath the sea. William O'Brien has found good gravel in this manner; Louis Lane and Ernie Blanck have begun drilling at the same place.——Near Nome the known extent of the third beach line has been increased one-half mile by its discovery by W. West on his claim west of the Humboldt claim. This is considered an important discovery.——It is reported that N. Butler and J. Plein have reached better gravel at Dry creek than that formerly worked on the ground.——Carliss Bros. are drilling for coal near Sinook river on Seward peninsula.——At the Slisco antimony mine at Manilla creek, 25 miles from Nome, an adit has been driven 300 ft. into the mountain; recently the owners found a gold-bearing vein that carries, it is said, $25 to $30 per ton, in addition to the antimony.——Joe Kennedy has found a copper-bearing lode on Brooks mountain.——The second beach line has been found on the California group of claims, 3½ miles west of Nome.——Peter Esch is developing a large body of iron ore near Sinook river.

ARIZONA.

COCHISE COUNTY.

Timbers are being prepared at the Savage mine for timbering the new shaft.——B. M. Pattison has resigned as superintendent for the Denn-Arizona and Shattuck-Arizona copper companies; S. A. Parnell will take his place.——It is stated that an English syndicate is negotiating with the Arizona-Apache company for the purchase of the Foran group of claims in the Catalina district.—At the Mayflower mine in Johnson district an inclined shaft 65 ft. deep has been sunk; it is announced that the company has decided to sink a vertical shaft on the hanging-wall side of the vein, and that a contract will soon be let for the first 300 ft. of this shaft. J. D. Sullivan of San Francisco is president of the company.

GILA COUNTY.

The Arizona Commercial Co. has announced that it will soon resume shipping ore from the Black Hawk mine to the Old Dominion and Shannon smelters, and probably to the smelters at Douglas. Recent developments on the 500-ft. level of the mine indicate continuance of the vein to considerable depth. A general sample of ore exposed in a winze east of the shaft carried 10% copper, 4 oz. silver, and 0.02 oz. gold per ton. The new three-compartment shaft on the Eureka claim will be sunk to a depth of 430 ft.

GRAHAM COUNTY.

The cost of producing copper at the Shannon property, it is stated, has been reduced over two cents per pound in the last two months, through the installation of new machinery and other innovations. N. L. Amster is president of the Shannon company.

MARICOPA COUNTY.

Part of the machinery for a 150-ton mill has been received at the Fortuna mine; it is hoped to have the plant completed in three or four months. F. W. Bithell is manager.

MOHAVE COUNTY.

A Los Angeles company is working the Jim Blaine mine, near White Hills; a good strike of silver ore was made there recently.——At the Victor mine the ore has been given a thorough test in the new mill, and it is thought advisable to start the tube-mill and cyanide plant.——J. E. Rose is preparing to mine the bars and bank of the Colorado river at a point north of White Hills.——At the Expansion mine in the Union Pass district a large force of men is working. A mill is to be erected soon.——A shaft is being sunk at the Billy Bryan mine.——Foster & Murphy have a large force of men at the Atlantic and Pacific mines near Thumb Butte, in the Union Pass district.

PINAL COUNTY.

The Keystone drills at the Ray copper mine have, it is said, brought to light some fine ore. Seven carloads of coal have been received by the company to keep up the work.

SANTA CRUZ COUNTY.

A Tucson publication announces that there is no truth in the statement recently made in local papers that the Mansfield company is sinking a shaft to the 550-ft. level in the Sweet mine and is mining ore on the 250-ft. level. It appears that at the time no work was being done at the property unless by the watchman in charge.

YAVAPAI COUNTY.

It is said that the owners of the Octave mine are planning to increase the size of the mill to 120 stamps, and that there is sufficient ore blocked out in the mine to supply such a plant for four years. On the 1600-ft. level an orebody 4 ft. wide has been found in a cross vein; it is quartz carrying much sulphide and streaked with gold. At the 1100-ft. level of the Joker mine there has been found an orebody that averages $33 gold per ton. The 40-stamp mill and 250-ton cyanide plant are running day and night. As the result of two weeks' run, the mill has yielded 1213 oz. of bullion.——The Black Mountain Copper Co. has purchased a hoisting plant and air-compressor; it is planning to sink the 135-ft. shaft several hundred feet deeper. The vein carries gold and copper.——At the Snoozer mine the burning of 90 cords of wood nearly set fire to the buildings.

The Interior Mining & Trust Co. has between 50 and 60 men employed at its property in the Black Rock district; the 40-stamp mill is producing $10,000 worth of bullion weekly.——At the Unida mine a large orebody carrying gold and copper has been found at a depth of 300 ft. in the new perpendicular working shaft; George Margaretis is general manager.——The Haynes Copper Co. has received five carloads of lumber for the construction of a power-house and gallows frame.——At the Binghamton mine at Copper Mountain I. T. Stoddard has been directing the laying out of a site for a 500-ton smelting plant and the building of a new road from Humboldt to the new townsite of Stoddard.——Some high-grade ore is being taken out of the Cardinal mine; it carries gold, silver, and lead.

YUMA COUNTY.

Geo. W. Norton and the Mathis brothers, it is reported, have made a rich strike about three miles east of Mohawk station. In sinking a 10-ft. shaft for assessment work they secured five tons of ore which, it is said, carries between 100 and 200 oz. silver per ton. A road is now being constructed from the railroad to the property, so that ore may be shipped to a smelter.

CALIFORNIA.

AMADOR COUNTY.

The mill at the Defender mine, about 12 miles east of Jackson, is crushing ore which carries about $10 per ton, and the tailing is being saved for further treatment. The Defender and Tom & Dick mines have come into the possession of the Amador Gold M. & M. Co., which is largely controlled in Boston; arrangements are being made for vigorons development. Large bodies of pyrite-bearing ore below the water level carry sufficient gold and silver to make shipment to smelters profitable.

BUTTE COUNTY.

Work will be commenced soon in building a road to the diamond mine, and when completed the mine will be prospected. The owners propose installing a Keystone drilling plant to determine the extent of the supposed diamond-bearing pipe.——The Steifer Mining Co.'s mine near Magalia is filled with water, and operations have been stopped in the mine until the company can complete a power-plant to pump the water from the mine. P. B. Steifer is superintendent.

CALAVERAS COUNTY.

The employees at the Melones mine, about 65 men, a large majority of whom are non-English speaking aliens, went on a strike Dec. 10 for a nine-hour work day.——It is reported that a dredge will be constructed on the Calaveras river at the mouth of Chili gulch.

INYO COUNTY.

(Special Correspondence).—J. V. McConnell is developing his group of six claims, 18 miles easterly from Big Pine; there are several shafts and an adit 60 ft. long. The lode is 2 to 4½ ft. wide and is exposed at intervals for the length of six claims; it is at a contact between porphyry and granite. The ore from all the openings varies between 5 and 30% lead and $66.50 and $148 gold and silver per ton.——Colorado parties are pushing development work in a very systematic manner at Chrysopolis. ——R. H. Blake is developing his silver-lead mine near the Montazuma mine; the lode is fonnd larger as work progresses.——Joe Wright, in doing his assessment work on his silver-lead property, has found the silver increasing as depth is attained.——Systematic work will be commenced in the spring at the Priscilla Hill gold mine.—— J. W. Tracy intends to erect a 10-stamp mill and concentrators at his mine on the west side of Gold mountain; the mine is developed by a 285-ft. and a 275-ft. shaft connected by a drift 280 ft. long. The ore in the bottom of the shafts is 6 ft. wide and carries $20 gold and silver per ton. This property produced much high-grade silver ore in the early days.——A number of prospectors left recently for Deep Spring valley and most of them are reporting good finds. Johnson & Epperly have an 8-ft. lode with a 10-in. streak of high-grade gold ore.

Big Pine, Jan. 18.

MODOC COUNTY.

A nugget of gold worth $40 has been exhibited in Alturas by a miner from the Mountain Sheep group of claims; there is 5 ft. depth of snow at the property now.

NEVADA COUNTY.

The vein being developed in driving the lower adit of the Ancho mine is proving wider than where first opened; the 10-stamp mill is running regularly.——At the Niagara mine near Deer creek, five stamps are crushing ore from the shaft; this shaft is now 325 feet deep.——At the Dewey mine Matt and Dave Waite have been taking ont ore that contains $16 gold per ton; the vein is 10 to 12 in. wide.—— Prospectors recently located some promising quartz veins in the French Corral district and will proceed with their development. Another prospector exhibits a piece of quartz float that is very rich in gold.

PLACER COUNTY.

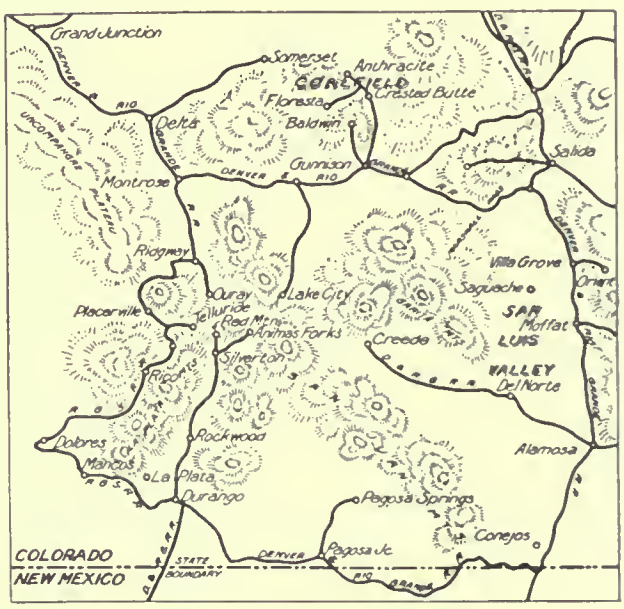
More machinery has been installed at the Dairy Farm mine.——The dredge at Cash Rock is to be in working order by March 1.——Forty men are working at the Slope mine near Forest Hill.——J. B. Patterson has started a new adit at his mine at Boulder Ridge near Penryn.—— At the Herman mine 20 men will be employed during the winter to finish the upraise and stope ore; the 10-stamp mill is running regularly.——At the Bellevue mine driving has begun on the 400-ft. level.——Preparations have been made for sinking a shaft at the Hathaway mine.——At the Orpheum mine the adit has been cleaned and retimbered.

SAN BERNARDINO COUNTY.

The Orange Blossom Mining Co. expects to install a stamp-mill at its property near Bagdad.——C. Ferguson has bought eight mining claims 3½ miles west of Kiinefelter station, and he proposes to commence work on them at once.——B. A. Jennings on Jan. 19 brought to Hart a sack of rich ore from the new strike at the Big Chief mine; every piece fairly glistened with free gold. Seventeen lessees are working on adjacent properties. A water-line is being laid from Malapai springs, four miles distant; telephone wires connecting with the Western Union wires at Barnwell, have been strung.

SHASTA COUNTY.

It is reported that on the 1100-ft. level of the Midas mine the vein has been uncovered for a distance of 200 ft. and that it is 18 in. wide. Sinking to the 1200 ft. level is now in progress.



Map of Southwestern Colorado.

SIERRA COUNTY.

The Sierra Buttes mine and mill have been closed by a strike of the miners, who demand recognition of their union. E. J. Olsen has a lease on the mine and will proceed to work it if the miners agree to accept 25c. per day less until May 1.——The Dead River Mining Co. has decided to resume development at the Wyoming mine in the Alleghany district; the lode is the one that created local excitement in November, as it was discovered in driving an adit to develop the Deep Blue gravel mine at Smith's Flat. S. M. Weiland is superintendent.

TRINITY COUNTY.

It is announced that work at the Bully Choop mine will probably be resumed as early in the spring as the melting of the snow will permit; dissention among the stockholders new perpendicular working shaft; George Margaretis is

TUOLUMNE COUNTY.

While no mill is dropping its stamps at Stent, 16 men are working at the Jumper mine, eight at the Santa Ysabel and six at the Mendonca mine.——At the App mine 140 men are employed.——Experts have estimated that the water in the Dutch mine is 850 ft. deep.

COLORADO.

CLEAR CREEK COUNTY.

(Special Correspondence).—The Creole and Argentine properties on Leavenworth mountain have been taken under bond and lease by Wm. Gibson, one of the pioneer operators. Mr. Gibson has started a new adit to cut under the old workings at a depth of 100 ft. In the breast there is showing a 2-in. streak of high-grade silver-lead ore that carries 149 oz. silver per ton.——Heavy shipments are being made from the Cram vein, intersected through the Doric adit, 2400 ft. from the portal. The ore is of a smelting grade and the first-class mills $134 per ton in gold, silver, and copper. Stoping is in progress and a streak of ore is being followed that measures from 18 in. to 3 ft. wide. The ground is being operated under lease by Gileen & Ecklund.——A rich strike has been made at the Hansbrough mine, Columbia mountain. In sinking prospect holes for the proving up of the ground a 6-in. streak of 400 oz. silver ore has been exposed. The ore carries considerable gray copper and glance. The adit is to be extended for the securing of additional depth, and the objective should be reached within 100 ft.——Work will be resumed in a few days on the Morning Glory adit on Saxon mountain. During the past several weeks a force of men has been engaged in cleaning out the workings and reducing the grade of the adit. It is understood that a compressor plant is to be installed. J. F. Puchert of Idaho Springs is superintendent.——The Linn Con. M. & M. Co. is employing a force of men in the construction of its new 50-ton mill. The building has been enclosed for some time, and a portion of the machinery has arrived. The balance has been shipped and should be here shortly. An aerial tramway is being constructed from the sixth level of the Mineral Chief workings, the terminus of which is at the mill bins. This tram will be 3000 ft. long. Frank Graham is in charge of operations.——The Raymond adit on Griffith mountain is being driven steadily forward, and according to surveys another vein should be intersected within the next few feet. Joseph Raymond of Georgetown is directing the work.——The Lincoln adit on Lincoln mountain, which was started to cut the Virginia City shaft workings at the 500-ft. station, is being advanced one to two feet per day. Within 90 days the objective will be reached, at which time the mine will be drained of its large bodies of water.——Enlarged operations have been put under way upon the Smuggler on Brown mountain. The third and fourth levels are being extended to the west and streaks of ore are being followed which are from 8 to 18 in. wide. A number of lessees are at work and steady shipments are being maintained. G. A. Huffman is manager of the property.——Louis Just, leasing on the Frostberg, is carrying a stope on a streak of $80 ore that is 18 in. wide.——At the Seven-Thirty mine Joseph Ebner is employing a force of men in steping upon an 18-in. streak of 240-oz. silver ore. Shipments are being made weekly. ——The Star property situated up Geneva gulch, is making a fine showing. Drifting is in progress upon a 6-in. streak of smelting ore that carries 140 oz. silver and 0.5 oz. gold per ton. Another adit has just been started for the gaining of greater depth. A force of men is now being employed in catching up a number of caves and in cleaning out the workings. John O'Dea is in charge of the work.——Steady shipments are being made from the Poorman mine in the Freeland district. This property is being operated by McKenzie Bros. and returns on the last shipment of 502 oz. silver per ton were received in settlement. Steping is in progress upon a 12-in. streak of mineral.—— The Rough and Ready adit in the same district, is being driven rapidly; it is being run on the vein, and in the breast there is exposed a 3-ft. body of mineralized quartz. ——A vigorous campaign of development is being waged on the holdings of the Atlantic M. & M. Co., situated in the Atlantic district. An adit tunnel has been started which will intersect the veins at great depth. A 6-in. streak of lead ore is showing which carries 52 oz. silver per ton and 55% lead.——The Tam O'Shanter group is being developed in a systematic manner. The adit, in 300 ft., is being advanced and another vein will be reached in another 30 ft.——'Bill' Young, the father of the district, is busily engaged in breaking ore on the lower level of the Smuggler. The ore carries $200 per ton in gold and silver. ——The Tyler adit has been advanced 300 ft. The last vein intersected shows a streak of heavy lead ore 8 in. wide. Drifting is now in progress for the proving up of the ground.

Georgetown, Jan. 18.

DOLORES COUNTY.

(Special Correspondence).—The United Rico Mines Co. held their annual meeting at Denver, on Jan. 14, and elected the following directors: David H. Moffatt, A. B. Roeder, Samuel Newhouse, Leopold Zimmermann, M. H. Hauser, Harry P. Scott, John E. Searles, Maurice P. Blumenthal, and Carl M. Owen. Resolutions were adopted commending the consulting engineer, H. A. Shipman, and the assistant general manager, A. Sheard, for the energy and fidelity which they had devoted to the interests of the company. The president's report and treasurer's report were presented, and they showed that the company was in a most satisfactory condition. In due course a financial statement will be sent to the stockholders. The president's report called attention to the fact that the showing from the first month's operations of the Pro Patria mill was excellent, and that shipments of both crude ore and concentrate had begun. Each week the company issues a statement in the local paper giving an account of progress.

Rico, Jan. 15.

IDAHO.

IDAHO COUNTY.

Development work at the Snowstorm mine near Red river was resumed early in the month; the intention of the management is to sink a winze near the face of the main adit.——The Dixie Royal Mining Co. is commencing operations on its group of placer and quartz claims, three miles below the town of Crooked Creek. A sawmill is being shipped to the property; lumber will be sawed this winter for the erection of a large mill in the spring. The ore consists of a porphyry dike 100 ft. wide that is said to carry $3.50 gold per ton; along one wall of the dike there is a vein 18 in. wide that is said to assay $100 gold per ton, while on the other side of the dike a quartz vein averaging 6 ft. wide is said to carry $35 gold per ton.——Scores of prospectors, it is reported, are hastening to a new camp near the head of the Middle Fork of the Clearwater river; they are attracted by a statement that B. C. Sweatt has there found a vein 12 ft. wide that carries $34 gold per ton.——The prospect of the building during this year of a large power plant, near the mining district along the Ten Mile creek between Orogrande and Buffalo Hump, has stimulated renewed activity there.

NEVADA.

ESMERALDA COUNTY.

The Nevada Legislature on Jan. 16 passed a resolution asking that the Federal troops be permitted to remain in Goldfield until the organization of a State constabulary or other police force sufficient to maintain law and order and suppress any domestic violence that may occur. President Roosevelt replied the following day that he will accede to the request, assuming that there will be all possible expedition in providing this police force. The charter of the Nevada Miners' Union, Incorporated, was filed with the County Clerk on Jan. 18. This is the union that is intended to displace the Western Federation in the Goldfield district, and has the moral support of the operators' association. None but American citizens are eligible. A portion of section three of the charter defines the purposes of the union as follows: "To secure the best wages possible for its members. To regulate the scale of wages between its members as well as between its members and other persons and corporations, and to make all necessary contracts to execute and carry out the same. And, as directed by its by-laws, to visit and comfort the sick, bury the dead, and care for the widows and orphans. This

corporation is not organized for profit and shall have no capital stock. A candidate for membership shall be a citizen of the United States or shall have declared his intention to become such."

The output of the Goldfield mines is very limited under present conditions; most of the working mines are simply developing their ore reserves. The Western Ore Purchasing Co. is receiving small lots of ore from the Florence Annex mine and from the Mohawk-Combination dump. The Combination mill is running at full capacity, treating 80 tons of ore per day, which is all taken from the Combination mine.——Within 60 days the Nevada-California Power Co. will have completed its parallel power-line from Bishop to Goldfield; 40 men are at work on the line.——The Florence-Gem lease has developed a 4-ft. vein of shipping ore which carries a 6-in. streak of ore that is plastered over with gold.——The Nancy Donaldson mine in the Red Mountain district, which produced high-grade ore two years ago, is to be developed on an elaborate scale.——The Diamondfield Red Mountain Mining Co. is sinking a shaft on its property; the ore developed by it carries from a few dollars to $664 per ton.——At the Idol's Eye claim in the heart of Goldfield a well-defined body of ore has been found.——A new district is that of Marlview, six miles from Thorne.——The Treasure Hill Mining Co. has 75 tons of high-grade ore ready for shipment from its mine near Silver Peak.——About 40 tons of ore from the Valcalde mine are being crushed daily; it yields $17 per ton. C. L. Knight is superintendent.——The Original Rawhide Mining Co. has about 50 tons of high-grade ore ready for shipment; the shaft is now 100 ft. deep.

LINCOLN COUNTY.

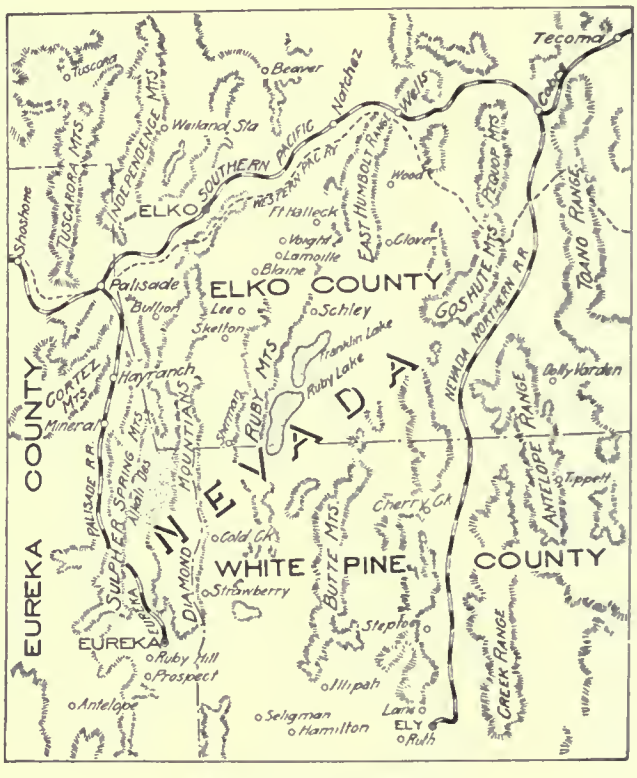
The New York-Searchlight Mines Co. is advertising for bids on 300 ft. of cross-cutting in its Waterspout mine, near Searchlight. The company will do the hoisting and to that end will install a 15-hp. hoist.——F. C. Perew has gone to Denver, Colo., to purchase a large mill for the Blossom mine in the northern part of the Searchlight district.——At the Colorado mine two large electric pumps, a 25-hp. hoist and a 50-hp. engine have been installed; vigorous development of the mine is shortly to begin.——The Nevada-Eldorado Mines Co., operating at Eldorado canyon, has developed down to a depth of 375 ft. a strong orebody of excellent milling grade.——Steady development has commenced at the Silver Dollar mine near Nob Hill; the mine has recently yielded some ore carrying 30% copper and much silver.——A 40-hp. hoist has been ordered for the Lodi shaft of the Philadelphia-Searchlight mine; a large body of low-grade ore is being systematically developed.——At the Blue Point mine there has been found an orebody 4 ft. wide which assays 2 to 20% copper; more energetic development is being planned.——A large body of ore that pans well in gold was found in doing the assessment work on the Florence group of claims. The ore is a heavy red-stained quartz; it is wider than the shaft at a depth of 30 ft.——A. J. Weeks and Walter Maxwell are driving an adit at the Alice mine to develop a lode that is 12 ft. wide and said to assay $5 per ton.——Smith & Bowman have installed a small hoist at the Shoshone mine, near Summit Springs, and have arranged to have ore milled by the New Era Co.; the ore they are now taking out is expected to yield between $12 and $15 per ton.——A carload of ore recently shipped by the Boston-Pioche Mining Co. from the Yuba East claim is estimated to contain a value of $110 per ton; shipping upon an extensive scale will be postponed until the shaft now being sunk is connected with the ore-shoot.

LYON COUNTY.

The 5-stamp mill at the Wheeler mine, which has heretofore been running for one shift per day only, is to be operated continuously hereafter; large bodies of ore are blocked out in the mine.——Two shafts on the property of the Yerington Copper Mountain Co. are said to be in good ore; the Lydia shaft has an 18-in. vein extending from the top to the bottom.——At the Mason Valley mine an adit is being driven to cut the lode at considerable depth. It is intended to resume operations on a large scale at an early date; the new power plant is completed.——The Wilson Gold Mines Co. has found a new body of rich ore in its mine in the Mountain View district; a contract has been let for driving a 100-ft. adit and at the same time the main shaft will be continued down.——At the Black Horse mine near Pine Grove an ore-shoot containing gold visible to the unaided eye has been found.——Wm. Richards and others have found on the Red Bird claim two well-defined veins that assay well in gold.——The McConnell shaft is still being sunk and is in the garnet-bearing limestone capping of the orebody; six men are working in it.——On the 550-ft. level of the Ludwig mine an orebody averaging 12% copper has been found.

NYE COUNTY.

The ore shipments over the Tonopah & Goldfield railroad for the week ending Jan. 16, as reported by the Western Ore Purchasing Co., aggregated 366 tons, divided as follows: Jim Butler, 175 tons; Tonopah Extension, 88; Midway, 103. The Tonopah Co. sent 2850 tons, the Belmont company 300 tons and the Montana-Tonopah 1100 tons to the mills, making the total shipments for the week 4616. The total output of the Tonopah mines was 4616 tons, of



Map of Eastern Nevada.

an estimated value (the shipping ore being valued at $50 per ton and the milling ore at $20 per ton) of $103,000.——On the lower levels of the Midway and Montana-Tonopah mines, work is being done under the direction of Mark B. Kerr to study the extent of the dacite intrusion that has given so much trouble in Tonopah mines. In the Midway mine the edge of one of the dacite tongues is being followed below the 800-ft. level; at the 900 ft. level the adjoining quartz body will be prospected, but sinking will be continued.——At the Tonopah Extension mine ore is being extracted on all levels above the 600 ft.; the north cross-cut on the 1050-ft. level is progressing satisfactorily.——Work is being pushed on all levels in the Jim Butler mine; the mill-dump is growing rapidly and the bins are kept full of high-grade shipping ore.——At the West End Consolidated mine the customary quantities of high-grade ore are being extracted; exploration is proceeding on the western extension of the 400-ft. level.—The clean-up of the Sunnyside mill in the Round Mountain district for December was $20,330.20; James McDonald is superintendent.

WHITE PINE COUNTY.

On the evening of Jan. 18, A. D. Bailey, Fred McDonald, and Pete Brown, the three miners who had been impris-

oned in the Alpha shaft of the Giroux mines for 45 days, were rescued; the entombed men had been working several hours in digging their way to freedom.——E. A. Harrington is developing the Columbia gold mine which is owned by W. D. Campbell; a small body of good milling ore has been found.——Lessees in the Black Horse district are sacking ore for shipment; some of this ore carries $800 to $900 per ton.——On Jan. 10 tracklayers reached the Veteran mine with the last rail of the ore line.

The management of the reduction plant which is being built by the Nevada Consolidated and Cumberland Ely companies has announced that work on the plant at McGill will proceed rapidly during this year; at least half of the great smelter and concentrator will be completed as soon as possible. Two units of the concentrating plant will be put into commission early, instead of one as previously planned.

NEW MEXICO.

SOCORRO COUNTY.

The developments in the Magdalena district during 1907 were of more importance than in any previous year. The Graphic company has exposed ore on the seventh, eighth, and ninth levels; the ore-shoot is about 400 ft. long and on the ninth level is 105 ft. wide. The ore is principally zinc sulphide, occasionally merging into zinc-lead sulphides, which require mechanical separation. Some of the ore carries 40% zinc, but most of it is low-grade, requiring concentration. The company has been experimenting with several milling processes and it is generally understood that it will soon install a concentrating plant.——At the Tri-Bullion mine a 250-ton concentrating plant has been installed; a large tonnage of both zinc sulphide and zinc carbonate ore has been developed in the Kelly mine.——The Mine Development Co. commenced shipping oxidized lead ore in September, but suspended about Dec. 1. It is now pushing the development of several mines along the Tip Top adit. The workings are all being driven in oxidized lead ore which contains about $1 gold per ton.——William Martin has been shipping lead carbonate ore that carried 8 oz. gold per ton.

WASHINGTON.

STEVENS COUNTY.

(Special Correspondence).—A new and important strike has been made in the First Thought mine, on the 200-ft. level.——Fresh capital has been obtained for development of the Chief & Butte mine and the working force will be increased. The products are bornite and azurite, and the value of the ore in copper is better than ordinarily found near the surface. There is considerable ore in reserve.——A new adit has been started on the Trophy mine.——The Katie mine on Toulon mountain is producing good copper-gold ore.——Work has been resumed at the Sure Thing mine, near Orient.——In Deer Trail camp considerable activity prevails; the Rosalie company is getting out tungsten ore of good quality.——The Germania Mining Co. is operating the Seal and Queen claims under bond and is ready to ship a carload of ore which carries 170 oz. silver per ton. The company is employing 23 men on these claims and getting considerable development work done.——The old Deer Trail mine is being operated under lease; a carload of ore was recently shipped.——The Togo mine is producing copper ore in small quantities.——In Chewelah district a 3-ft. vein of copper carbonate has been cut in the lower workings of the Copper Jack mine. In the Jay Gould mine a drift on the 200-ft. level has been driven 48 ft. in galena and copper concentrating ore; a cross-cut has been started on the lower level.

At the United Copper mine, on the 400-ft. level the vein has been followed over 200 ft. There are 150 tons of ore on the dump. A late report stated that 18 in. of gray copper had widened farther on to the full width of the drift, 6 ft.; an assay ran 16.3% copper, 150 oz. silver per ton, and a small value in gold. The working force has been increased from 15 to 30 men, and five more teams have been engaged, to increase the haulage and shipment of ore.

Republic, Jan. 17.

CANADA.

BRITISH COLUMBIA.

The enlargement of the lead plant at Trail now makes it unnecessary to ship any St. Eugene lead concentrate to Europe.——During the past five months the Granby Consolidated M. & S. Co. has added to its smelting plant a new line of coke and ore-bins 800 ft. long, and a new structural dust-chamber. In a short time it will be smelting 3200 tons of ore per day. It has plenty of coke on hand and can get all the men it wants at reasonable wages; unless something unforeseen happens it expects to treat its normal amount of ore every month.——The 200-ton mill at the Blue Bell mine near Nelson is nearly completed; in a short time the company will resume the development of its ore-bodies.——The Elmore Oil Process Co. is erecting a small mill for the reduction of ore near Golden.——At the Little Bertha mine a concentrating plant may be erected; the mine is to be operated to its full capacity.——The Providence Mining Co. is advertising for bids for an issue of $50,000 in bonds.——Hedley Miners' Union No. 161, it is understood, has accepted the lower wage scale which went into effect on Jan. 1, being that now in force in Phoenix, with some exceptions.——A 4000-ft. adit for the Krao mine at Ainsworth is proposed.——Sand from near Quesnel, tested in New York, gave 3 oz. platinum per ton; its working will be profitable if it can be concentrated. Work at the Slocan Bell mine has opened some small ore-shoots.——The shaft at the Orphan Boy mine near Kamloops is being deepened to 100 ft.——Delay in the arrival of tramway fixtures has prevented ore shipments from the Eureka mine in Star gulch.——At the Kokomo mine an orebody 6 in. wide has been found.

ONTARIO.

During 1907 the mines of the Cobalt district shipped 14,040 tons of ore, valued at between $10,000,000 and $12,000,000. The following are the shipments in pounds from the various mines: Buffalo, 2,208,820; City of Cobalt, 101,280; Conlagas, 4,798,710; Cobalt Central, 101,360; Colonial, 74,250; Drummond, 108,920; Foster, 611,806; Green-Meehan, 196,780; Hudson Bay, 243,170; Imperial Cobalt, 37,530; Kerr Lake, 644,800; King Edward, 62,250; La Rose, 5,706,875; McKinley-Darragh, 1,407,935; Nipissing, 4,788,249; Nova Scotia, 493,000; O'Brien, 2,666,360; Red Rock, 91,443; Right-of-Way, 258,220; Silver Leaf, 93,618; Silver Queen, 957,157; Tretheway, 1,710,438; Townsite, 234,278; Temiskaming, 430,611; University, 61,388. Total, 28,081,010 pounds.

YUKON.

News of three rich strikes in the Peel River and Sulphur Dome districts has reached Dawson. Indians have brought to Dawson from Peel river samples of decomposed rock abounding with gold.——At Haggard creek in the Sulphur Dome district placer ground yielding from 60c. to over $3 coarse gold per pan has been found. The alluvium along the creek has all been staked and will be thoroughly explored before spring.——It is also reported that rich placer ground has been found near the head of the White river, where many Yukon prospectors are spending the winter.

A rush of prospectors has followed the discovery of rich gravel on Black Hills creek, a branch of Stewart river; the alluvium has been staked from Sixty above to the mouth of the stream, 33 miles, the last claim being No. 164. Stampeders are staking the tributaries. The valley of Black Hills creek is not proved ground, but rich gravel has been found on No. 112 below, No. 7 below, Discovery, No. 11 above, No. 23 above, and a few other claims; over 100 men are working enthusiastically in the valley.——On the left fork of Little Branch creek near Dawson, 5c. to $1.40 per panful of gravel have been secured. A strike has been made by Tom Babcock, Al Lobley, and Nathaniel Mercer on No. 10 claim; the alluvium has been tested by a cross-cut 22 ft. long and rich gravel is present throughout it.

Special Correspondence.

London.

Engineers and Capitalization of Mines.—A Suggestion to the Institution.—Tanganyika Concessions.—The Frecheville Report.—Australian Smelting Corporation.—De Beers and the Diamond Trade.

In your issue of November 2, Mr. T. H. Leggett deals with a subject that is of considerable interest to English mining engineers. His letter was written with the purpose of showing that the engineers on the Rand have no voice in the capitalization of the mining companies, and he mentions that as a rule the engineer is never asked by London promoters for his opinion as to what capitalization a particular mine will stand. It is this point that I wish to enlarge upon. In London, mining engineers may be divided into two groups. In the first group there are such firms as John Taylor & Sons and Bewick, Moreing & Co., who not only send their engineers to inspect properties, but also form companies and raise capital to work them. The other, and larger, group consists of those who are purely engineers, who are deputed by financial houses either to examine mines or to manage them. Sometimes these engineers give their services entirely to one financial group, as is the case with the engineers employed by the South African houses, and in other cases the engineers enjoy an independent consulting practice.

The grievance, sometimes expressed, but more often not, of this second group of engineers is that, as Mr. Leggett says, they are never consulted about the capitalization of the companies formed to acquire particular mines. The consequence is that many a time a mining engineer who has reported favorably on a mine or who has been manager of a mine, finds that his report or work is used against him when the mine has proved unequal to the task of recouping shareholders for the capital sunk in the company. He naturally knows that his experience of mining has not been fully used for the benefit of the shareholders, but as yet he has no redress. The financiers and the Stock Exchange are too strong for him. Unless he deports himself as the 'City' requires, he is of no use. Pessimistically speaking, he is a mere hewer of wood and drawer of water. As a rule he says to himself: "I have come to the City to do business and I must make up my mind to pocket my own feelings and do as the City does." It is not only that the nominal capital of the company is placed at far too high a figure, but that the underwriters and Stock Exchange further inflate the price of the shares. The directors of such companies generally plead ignorance of the reason why such inflation has taken place and of the identity of the inflaters, but their protestations are usually insincere.

How engineers are to combat this incubus of overcapitalization and inflation is not quite clear, as the financiers occupy the citadel so strongly. But it is obvious that until the engineers are allowed to give their opinion on the subject, mining as directed from the city of London will not be as sound a business as it should be. Eventually I hope that engineers as a body, through the Institution of Mining & Metallurgy, will take some steps, slow but sure, toward making the engineers' opinion on the money value of a mine of greater weight among investors and shareholders. I put forward this suggestion to the Institution in all seriousness, for this, as much as anything, will elevate the profession and increase its dignity and influence.

A week or two ago I sent some information concerning the great copper deposits in northern Rhodesia, owned by the Tanganyika Concessions Limited, and I mentioned that everybody was looking forward to Mr. R. J. Frecheville's report. Your readers will remember that the earliest information about these deposits was received with scepticism on account of the unusually glowing nature of the reports. Subsequent information went far to confirm the first news. Recently Mr. R. J. Frecheville went out for the Consolidated Mines Selection Co., so as to advise his company on the desirability of taking up an interest, and I said that, for myself, I would accept Mr. Frecheville's views as conclusive. It appears, however, that there is very little chance of his report being made public. The position is somewhat humorous. Seeing that he was sent out at considerable expense by the Consolidated Mines Selection Co., his report will not be handed over to anybody else without the payment of a considerable fee. As a matter of fact, the amount asked is £4000. This amount, neither the Tanganyika Concessions, nor the Union Miniere Co. of Brussels, which is working in conjunction with the Tanganyika Concessions, is inclined to give, which is a pity. In the meantime it is interesting to note that the arrangements for smelting the ore are proceeding apace, and that Mr. Allan Gibb, the metallurgist, speaks very confidently. Mr. Gibb is a Royal School of Mines man and son of the late Thomas Gibb, who was for many years with the Broughton Copper Co. of Lancashire. Until recently Mr. Allan Gibb has been engaged in copper smelting in Queensland.

The troubles of the Australian Smelting Corporation are by no means over. A few weeks ago I gave some information, at the time when the first annual report was issued, and I sketched the history of this undertaking. The directors have issued a circular to the shareholders stating that the negotiations for the sale of new shares have fallen through and that there is no alternative but to reconstruct the company and assess the shareholders. It appears that the immediate reason for this crisis is the opposition on the part of some of the shareholders to the policy of the directors, and that in consequence the calls on £20,000 worth of shares cannot be collected. Legal proceedings are being taken by the board to enforce the payment of these calls, but the action will not come on for yet a while, and in the meantime the funds of the company are exhausted and progress in erecting the smelter at Port Kembla is interrupted. In order to raise further funds, negotiations were opened with certain parties in Australia whereby a block of 7% preference shares would be taken up. Unfortunately, however, the price of metals has fallen to such an extent that these people in Australia have changed their minds and withdrawn from the negotiations. It is impossible to create any more debentures, as the legal limit has already been reached. The directors have, therefore, no option but to ask the present shareholders to put up further funds in order to keep the company going. There are 140,000 shares, and a 5s. assessment will bring in £35,000, supposing that everybody takes up his quota. But as there are already some 20,000 recalcitrant shares, and as there is further discontent among shareholders, it is difficult to say how much money will be subscribed. The outcome of these proposals will be awaited with interest.

The London market has been paying a good deal of attention to De Beers and other diamond companies' shares during the last month or two, owing to various happenings. It is customary for the De Beers company to pay an interim dividend on the deferred shares at about this time. It came as a surprise, therefore, to find that no such dividend is to be paid this year. All sorts of rumors have been disseminated in explanation of the

event. Approaching exhaustion, competition of other producers, decrease in the demand, and other reasons are freely mentioned, but nobody outside the control knows the whole truth. The De Beers company makes up accounts yearly to June 30. The last report, for the year 1906-7, showed gross receipts £6,570,000 and dividends £2,550,000, both being an increase over the previous year. The directors state that the production and profits so far during the current financial year (beginning July 1, 1907) show no falling off, but that owing to the slackening of the demand they consider it best to make no disbursement in the way of interim dividend, preferring to keep large sums of money on hand. I believe that the American financial stringency has a good deal to do with this slackening of the sale of diamonds. It is probable, also, that the large output of the Premier mine is affecting the De Beers considerably. It is interesting to note that an agreement has been arrived at between these two companies for controlling the disposal of their products. Nothing is said in the recent reports about the present productiveness or the future prospects of the De Beers mines, but it is well known that the yield per load has been decreasing, and that the output of blue ground has been increased in order to maintain the output. At the present time the intention of the directors is to curtail the production to make it commensurate with the demand. Another worry that the directors have is the increasing pressure of taxation both in Cape Colony and in England. The taxes have been materially increased in Cape Colony and amount to something like £300,000 a year. In England the courts have recently held that the company, though registered in Cape Colony and operating there, is liable for the English income tax of 5% on the whole of its profits; this materially affects the profits.

Johannesburg, Transvaal.

Decline in Share Values. — A Comparison. — The Figures for November.—Better Supply of Kaffir Labor.—Labor Problem not Solved. —A Stope-Drill Competition.

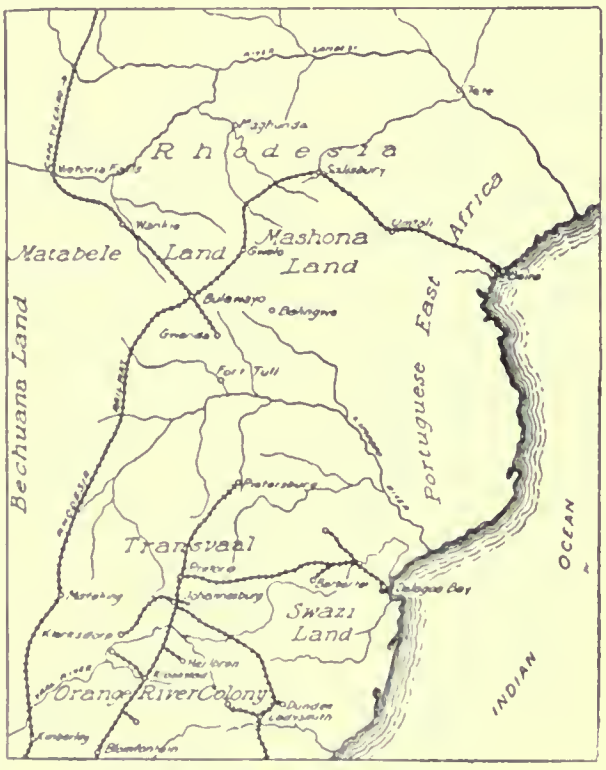
In looking over some old papers the other day, the writer came across a price list of shares of the Rand, dated October 13, 1902. A comparison of the prices prevailing today, with the values in 1902, shows what an awful shrinkage has taken place in the values of Transvaal shares during the past five years. Just after the war optimism ran riot, and it seemed possible to float any piece of land in the Transvaal as a gold mine. A few far-seeing hard-headed men warned the public that prices were entirely too high, and that a collapse was inevitable. But a veritable craze for 'deep levels' was raging, and people seemed to think it would be possible to follow the reef to the centre of the earth and make it pay all the way down.

But the prices of today show what a collapse has taken place. I pick out a few stocks at random, giving their prices five years ago and today:

Mine.	Price Oct. 13, '02. £ s. d.	Price Dec. 12, '07. £ s. d.
Rand Mines	11 9 0	5 4 0
Barnato	3 6 0	1 0 0
Jupiter	3 10 0	0 12 6
Albu	3 6 9	0 19 3
Anglian Mining	1 2 9	0 1 6
Cinderella Deep	3 0 0	1 15 0
French Rand	3 13 6	0 16 0
Randfontein	3 4 9	1 10 3
Simmer East	3 19 0	0 9 6
Robinson Central	4 5 6	5 0 0
Wit Deep	4 1 6	3 10 6

A striking feature about this depreciation is the fact that shares like Rand mines, which were spoken of as safe as the bank of England should have tumbled so disastrously. The 'safe' shares have had the same fate as the highly speculative ones, and in only one case, that of the Robinson Central Deep, is the valuation higher today than in 1902. Jupiters show the awakening of the public as far as the 'deep deeps' are concerned. While the 'deep level' fever was raging, this mine, which strikes the reef at about 4000 ft., was valued by the public at 70s., but in these days of reflection it stands at only 12s. 6d., a figure quite high enough. A few people here and there who have saved something from the wreck, are buying up some of the sounder shares on the Rand, as they declare that at the present prices they can get a good return for the money invested.

The performance of the mines for the month of November is highly creditable. In a month of 30 days the output shows only 3752 oz. less than for October, which had one day more. The total yield was 519,801 oz., valued at £2,335,406. During November three companies produced over 20,000 oz., while there were twenty yielding



Map of the African Goldfields.

10,000 oz. and over. On account of losing a large number of Chinese coolies during November, the Simmer & Jack mine, which generally heads the list, gave way to the Robinson company, which produced 25,300 oz., the output of the Simmer & Jack being 21,210 oz. The third producer was the Robinson Deep, with 20,621 ounces.

As regards native labor, there were 10,990 natives distributed during November, while 7091 departed, showing a net gain of 3899. There are now 107,556 Kaffirs at work on the Rand, probably the highest number on record. During November there were 4610 Chinese laborers lost by repatriation, death, etc., and there are now 37,728 indentured laborers in the Transvaal available for work on the mines. So far the replacement of Chinese by Kaffirs has been most satisfactory and as yet no trouble has been experienced in procuring sufficient labor. Of course Het Volk, the Boer party, is jubilant over this fact, and are never tired of rubbing it in that the importation of coolies was unnecessary. But they are crowing too soon. At present there is one of the worst depressions ever known in South Africa, and the natives are forced by the economic situation to

come to work. If prosperity ever returns, the supply of Kaffirs for the mines will fall off automatically.

The men who see the future clearly, such as mine managers, consulting engineers, and technical newspaper men, realize that the labor problem is by no means solved, but that we shall be "up a tree" if we don't look ahead. For this reason every effort is being made to find out the best small rock-drill to replace hand labor. There are many on the market, and in order to prove which is the best, *South African Mines* has started a competition, which is being patronized by all the small stope-drills on the market. This well known technical journal has shown the most commendable public spirit in this vital question of the finding a suitable power-drill for the small stopes of the Rand, and if it succeeds, the labor problem will be partly solved. It is because of the unsuitable underground conditions that so much hand-labor is necessary on the Rand. The extension of labor-saving devices, with the probable increased use of white labor, might yet solve the difficulties of the mining industry of the Transvaal.

Guanajuato, Mexico.

The Consolidated Co.—Description of the Mill.—Composition of the Ore.—Good Results.—The Mineral Development Co.—A Deep Shaft.—San Matias.—The Pinguico and Peregrina Mines.

The Guanajuato Consolidated Mining & Milling Co., controlled and managed by the MacDonald brothers, is mining and milling 300 tons of ore per 24 hr. A one-mile cross-cut equipped with facilities for electric haulage affords access to the main orebodies. The present active workings are all below the main haulage level, and the electric hoists used in lifting the ore from the lower levels are installed at under-ground stations. At the portal of the main cross-cut are the electrically driven air-compressors, crushing plant, and sorting tables. The ore, after being crushed to 1-in. size, is hauled to the mill in self-dumping cars by electric locomotives, the distance being 2800 ft. The mill has 80 stamps, 1250 lb. each, crushing the ore in cyanide solution, discharging from the mortars through 50-mesh screens. This is followed by cone-sizing, the slime passing to settlers, the heavier material to Wilfley and Standard tables. The table tailing passes to Frue vanners, the tailing from the latter to cone classifiers, in which the sand and slime are separated.

The sand is conveyed to leaching-vats and the slime to pulp-thickening vats. In the latter the slime is thickened to 68% moisture and sent to the leaching-vats where the pulp undergoes agitation for 24 hr. by mechanical agitators and centrifugal pumps, a stronger cyanide solution in the meantime being added. After settling six hours the enriched solution is decanted and passed to clarifying vats, thence to the precipitating room. The same material, from which the solution has been drawn, is again agitated in wash-water and the dissolved metals again drawn off. The company has installed a Ridgway filter-press, which is intended to handle the final slime that now discharges into the creek. This is of Australian design and has been successfully used in Australian mills. The machine is being tried, with the intention of adding others of the same kind if this one proves successful. The sand undergoes four days treatment in one set of vats and is then transferred to other vats in which it receives from eight to nine days additional treatment. The concentrate from the tables and vanners, which is sent to the smelters, carries about 50% iron sulphide and 5% silica. The ores carry about 85% silica, 4 to 5% iron, having a total value of P25 per ton, 10% of which is gold and 90% silver. The extraction is stated as 90% of the silver and 97 to 98% of the gold. By the use of filter-presses it is anticipated that even a higher extraction will be reached, especially as to the silver.

For sand treatment the solution is 0.035% cyanide, this stage terminating with a weak solution containing 0.01% cyanide and a final water-wash. In the slime treatment eight solution washes and two to three water-washes are given, the strength of solution being 1% cyanide. Lime to the amount of 1% is added to the pulp in the batteries and another 1% to the sand when it is transferred from the upper to the lower vats. The same amount of lime is also added to the slime when charging. To the slime is also added 0.15% of lead acetate and to the sand 0.05%. Ten tons of solution is used to one ton of ore; and seven tons of solution to one ton of ore is passed to the precipitating room. The consumption of zinc amounts to 1.37 lb. per ton of ore treated. The consumption of cyanide is 2.86 lb. per ton of ore. Bernard and Joseph MacDonald are concerned in the active management of the property. W. B. Timins is mining engineer and surveyor; Parish MacDonald, mill superintendent; R. Vaughn, superintendent of cyanide plant.

The Mineral Development Co., organized by mining men and engineers of New York, Philadelphia, and elsewhere is sinking a prospecting shaft on the Nueva Luz, adjoining the Valenciana, near Guanajuato. The shaft is three-compartment, 8 by 17 ft., is equipped with a double-drum electric hoist and an Ingersoll-Rand air-compressor. The depth already attained is 1000 ft. and the plan is to sink to a depth of 3000 ft., with the idea of cross-cutting from various stations to the Veta Madre. This company has a concession from the Mexican government whereby it is to receive a subsidy for depth attained below the 500-m. level. H. H. Miller, one of the stockholders, is the company's manager.——The San Gregorio Mining & Railway Co. was organized in New York to take over the San Gregorio mine and a local railway that starts at Marfil. This company purposes reopening the mine and prospecting other property.——The Mexican Milling & Transportation Co. is to build a standard-gauge railroad 36 miles long to afford transportation to practically all the mines and mills of the Guanajuato district. This is one of the Guanajuato companies of which Geo. W. Bryant is general manager.

Mexico.

The San Matias mill of the Mexican Milling & Transportation Co. has 40 stamps crushing the ore in cyanide

solution through 35-mesh Tyler slotted screens. This is followed by concentration over Wilfley tables, the middling passing to Frue vanners and the tailing to cement slime plates. The coarse tailing is re-ground in a 14-ft. tube-mill, the product of the latter passing to the cyanide plant, where the sand and slime are separately treated, the slime being treated in connection with agitation and Butters vacuum filters. The mill has a capacity of 5000 tons per month. C. E. Rhodes is superintendent of the San Matias mill and the San Prospero mine.—— The Pinguico mine and mill of the Guanajuato Development Co. are situated four miles from Guanajuato, on the rhyolite bluffs overlooking the valley and plain. What is now the principal Pinguico shaft is 800 ft. deep. It sinks in the foot-wall, the ore being opened by five levels running northward on the vein. These levels are 73, 103, 125, 145, and 185 m. respectively from the surface and they represent 1200 m. of drifts on the vein. The levels are all connected by raises and winzes every 50 feet.

The principal ore-shoot is stated to be 10 m. wide, the value of the ore averaging 2000 gm. silver and 20 gm. gold per ton. The vein matter is soft, requiring timbering. As the work proceeds north the vein becomes narrower and the ore hard, there being rich streaks 2 m. wide, assaying as high as 20 kg. silver and 200 gm. gold. This shaft is equipped with an Ingersoll-Rand compressor, electrically driven; a 150-hp. electric hoist, machine shop, sampling room, ore-bins, and a railroad track from the bins to the mill. A second shaft, 175 m. deep, situated a short distance from the one already described, is to become the main working shaft. The 40-stamp mill, which treats the Pinguico ores, is about one mile from the mine and is operated by electric motors. In addition to the eight 5-stamp batteries the equipment comprises two Chilean mills, one Bryan mill, Wilfley tables, Dorr classifiers, 30 sections of cement slimers, and cyaniding equipment. With the machinery and devices named, the ore is crushed, classified, concentrated, the coarse re-ground, the sand and slime separated and cyanided. R. L. Armit is general superintendent of the Pinguico mine and mill; G. M. Henderson being the mill foreman.

The Peregrina mine and mill, one of the numerous properties controlled by Mr. Bryant and associates, is about seven miles from Guanajuato. With 120 stamps in operation, the plant treats between 400 and 500 tons of ore per day. The Peregrina ores carry gold and silver in a gangue which in some parts of the mine is hard quartz and in others a decomposed material. In the former the precious metals are associated largely with pyrite; in the oxidized material much of the gold is in a free state and the silver a chloride. The mine is opened through a main haulage adit, 350 m. long, intersecting the series of parallel veins. The ore now being produced is hoisted by electric motors to the main haulage level. The milling method here does not differ radically from the general practice of the district. The table product, resulting from concentrating the heavy material from the batteries, amounts to about two tons per day. The table middling is re-ground in a tube-mill; the lighter slime, overflowing from cone-classifiers, goes to slime-collectors. The re-ground product from the tube-mill passes to cone-classifiers, in which a separation of sand from slime is made. The usual method of leaching the sand in large steel vats and cyaniding the slime in agitating vats follows. Butters filters are employed in drawing the solution from the flocculent slime material; Blaisdell excavators and belt-conveyors are used in discharging the sand after leaching. J. J. Hollister is manager of this property.

Butte, Montana.

The Smoke Suits.— An Injunction Unlikely.— Local Conditions Unchanged.— The Great Falls Smelter.— Schwab and the Corry Claims.—Rapid Shaft Sinking.—East Butte.

The modifications made in the smelter smoke injunction suit by Oliver Crane, Master in Chancery of the Federal Court, are much more favorable to the Amalgamated Copper Co. than the findings in the origiual draft were, and it is claimed that if Judge Hunt approves the findings he may well and consistently refuse to issue an injunction to close the Washoe smelter at Anaconda. The Master finds that no permanent injury has been done the land by the arsenical fumes from the smelter, and that if the smelter were closed for one year all the land would become free of the accumulations, for since September, 1903, when the big stack was completed and put in use, the precipitation in nowise damaged the land. There is a possibility that the present suspension of the Washoe smelter may therefore give the land time to absorb the accumulated noxious substance and solve the question of a permanent injunction. The findings on the question of no permanent damage to the land is emphatic. Judge Hunt is not likely to be able to consider the findings and give a decision within the year.

The condition of the copper market does not encourage the hope that there will be an early resumption of mining by the Amalgamated Copper Co. in the mines that have been closed for several months. While general business conditions appear to be improving there is nothing to justify an increase in production. The Boston & Montana Co., the only subsidiary of the Amalgamated that is mining, has not yet reached its operating capacity, although it was announced at the time of the suspension of the other mines that the Boston & Montana would be worked to full capacity, and would produce the same amount of copper as the other mines had been producing. The North Butte is shipping a limited quantity of ore to the Clark reduction works, but the Butte Coalition is not mining any ore at all. "The reduction works have been handling some of the North Butte ore, and additional converters being installed will make it possible for them to handle more ore, but the entire capacity of the smelter is not great enough for the North Butte normal output, let alone that of the North Butte and Clark mines together," said A. C. Carson, general manager of the North Butte. At the Great Falls smelter of the Boston & Montana Co. the half-time system is being worked, due to the desire of the Amalgamated to give employment to as many men as possible. Men are allowed to work only half time, and in that way twice the number usually employed are given work.

It is understood that the Davis-Daly Estates people are negotiating with an English syndicate for the placing of a lot of Davis-Daly stock, by which the company treasury will receive $1,100,000 cash at once, and $600,000 in deferred installments.—— It is learned that before the financial panic a representative of Charles Schwab was negotiating for the acquisition of the Corry group of copper claims in the district east of Butte, on the main range. The Corrys own a hundred or more claims in that district, and several claims have been opened sufficiently to disclose the copper veins. Schwab offered $1,000,000 for the property, agreeing to pay $250,000 in cash, and give stock for the balance in a company to be organized. The Corrys declined the offer, but it is understood that negotiations have not been abandoned, though they have been deferred.

The Butte-Ballaklava Copper Co., which capitalized six acres of ground for $6,000,000, is sinking a new shaft and also opening the old one on the Burke claim. In

the old workings, at a depth of 510 ft., it has opened a vein which the management claims to be the Edith May vein of the North Butte Co. The vein there is 28½ ft. wide. A cross-cut is being run north from the shaft, and has also intersected another vein. It is claimed that picked samples of the ore assays 18% copper, 30 oz. silver, and $1.20 gold. It is the intention of the company to drift east and west on the vein, the west drift to be carried 500 ft. to connect with the new shaft. The new shaft is down 300 ft., and fair progress is being made with the temporary plant. The company intends to install a new plant, and the equipment will include an electric plant for the operation of compressor and pumps.——The record for shaft-sinking in the Butte district probably belongs to the Pilot-Butte Mining Co., which sank a four-compartment shaft 250 ft. in two months. The shaft on the Pilot is now 515 ft. deep, and a station is being cut at the 500. At the 500 in the Elm Orlu, an adjoining property, a big vein of copper-silver ore has been opened by W. A. Clark, and on the 700-ft. level a big body of copper glance has just been found.

Salt Lake, Utah.

A Mine-Owners Association.—The Yampa Smelter.—Another Consolidation.—Dividends.—Shipments From Tintic.—Lower Mammoth Co.—Less Demand for Coke.—Boston Consolidated.—The Mascotte Adit.—Smelter Fumes.

The mine-owners have effected an organization which is to be known as the Utah Mine Operators Association. The president is John Dern, of the Consolidated Mercur Gold Mines Co.; Thomas Kearns, manager of the Silver King Mining Co., is first vice-president; W. F. Snyder, manager of the National Development Co., second vice-president; Harry S. Joseph, manager of the Silver Shield Mining Co., secretary; C. E. Loose, manager of the Grand Central Mining Co., treasurer, who, with Lafayette Hanchett, W. C. Alexander, George W. Riter, and Ernest Bamberger, comprise the executive committee. Various sub-committees have been named, and the organization has settled down to business. About 90% of the operating mines of the State are represented in the organization, which was affected amid much enthusiasm, as the mine-owners are unanimously of the opinion that the existing custom smelting companies operating in the vicinity of Salt Lake have made them victims of arbitrary smelting rates. The new organization has already placed itself on record as favoring the independent smelter movement launched in this city recently, and passed a resolution urging upon Congress to establish a government assay-office at Salt Lake City.

The management of the Yampa Smelting Co., operating a plant in Bingham canyon, has announced the intention of installing a two-stand converter plant, which will make this company entirely independent of all other local smelters. Heretofore the Yampa company has shipped its matte to the United States Smelting Co. for converting.—— The Tintic Mining & Development Co., of which the Yampa Smelting Co. is a subsidiary, will shortly begin work on its Tintic properties after a shut-down covering many years. Recent developments made in the Colorado and other mines has demonstrated that the Tintic property is well situated. It is the intention to sink the shaft to a depth of 1500 ft., and extend intervening levels.—— Negotiations are pending for a consolidation of the properties owned jointly by the Nevada Utah Mines & Smelters Co. and the Ohio Kentucky Co. at Pioche, Nevada. Representatives of both companies are now in the East for a conference on the matter.

Two Utah mining companies have posted dividends within the past week, namely, the Mammoth, for $40,000, and the Utah (of Fish Springs), for $3000.—— Ore shipments from Tintic last week were reduced to 46 carloads, the smallest in eight years, the shippers and amounts being: Centennial Eureka, 38; Tintic Iron, 5; Eureka Hill, 3 carloads.

At the annual meeting of shareholders of the Lower Mammoth Mining Co., operating in the Tintic district, a new board of directors was chosen consisting of A. C. Ellis, J. J. Stewart, John Dern, W. S. McCornick, M. P. Braffett, H. G. Williams, and E. C. Coffin. The mine superintendent recommends that the shaft, which is now down 1200 ft., be sunk to the 2000-ft. level, it being estimated that the orebody will be caught on its dip at about 1900 ft. The financial statement shows that the company sold ore to the amount of $123,467 in 1907, and that $57,000 was disbursed in dividends. It is estimated that the ore in reserve is double that extracted last year.

Owing to the shutting down of so many smelters and mines throughout the West during the past few months, there has been a great falling off in the demand for fuel, with the result that some of the coal companies have begun to curtail work. Some mines have been closed entirely, but as yet there has been no great reduction in the number of miners employed; however, in numerous instances, the men are working only about two-thirds time. The closing of the smelters in Montana and in the Salt Lake valley greatly reduced the demand for coke.

The Boston Consolidated has placed its new surface tramway in commission. It transports the ore to the new concentrator at Garfield. The starting of the tramway has been delayed by the accident to the pumping plant which resulted in the death of L. H. Wheeler, superintendent of construction.——The Mascotte adit of the Dalton & Lark mine which is to be utilized in the future by the Ohio Copper Co., has been pushed ahead to a point within 600 ft. of being directly under the vertical shaft with which it will connect. The adit is now draining the mineralized zone of the Ohio and work is about to be resumed in the shaft. For several weeks the adit has been driven through a well mineralized region, with encouraging assays for gold. The construction of the new mill is going forward steadily. The company recently cleared up its financial obligations and is now prepared to round out its enterprise as planned.

The smelter of the United States Smelting Co. is still being operated; and while the plant may go down for a time, it is claimed that the company is getting ready to go into court to show that if granted a modified decree, as was the case with the American Smelting & Refining Co., as regards its Murray plant, it will be possible to keep within the law; and that such devices have been installed to control the fumes that there is little danger of damage being done to vegetation. Negotiations have been resumed with the farmers with the object of getting them, for a consideration, to sign smoke easements on their lands as they did with the American Smelting & Refining Co. last year. The shutting down of the Utah Consolidated and Bingham Consolidated plants and the dismissal of so many men has had a salutary effect on the farmers and they are not nearly so hostile as they were a few weeks ago. Nevertheless, some of them are hard to pacify. The most recent smoke agitation started has been the filing of claims against the Yampa Smelting Co., operating in Bingham canyon, by the owners of farms ten miles distant from the works. The Yampa management, however, will fight the cases to the bitter end if they are taken into court. It is ridiculous to suppose that the fumes from this plant ever get down into the Salt Lake valley.

Denver, Colorado.

Land Frauds. — Water Famine. — The Portland and Mr. Burns. — Activity at Aspen.—Mining at Boulder.—Leasing Successful at Cripple Creek.

The Federal grand jury returned an indictment charging W. R. Mason and Joseph Vanderweide with conspiracy to assassinate Joseph A. Walker, the secret service agent, whom Vanderweide shot and killed at the Hesperus mine near Durango last November. Indictments were also returned against E. M. Biggs and W. W. Nossman on the charge of conspiracy to obtain 8000 acres of government land by illegal methods for the benefit of the New Mexico Lumber Co. This indictment is similar in import to the ones recently quashed by Judge R. E. Lewis, when he rendered his decision upholding the 'dummy entry' system. The government prosecution has been greatly hampered by the loss of Walker, who was the chief witness in these cases.

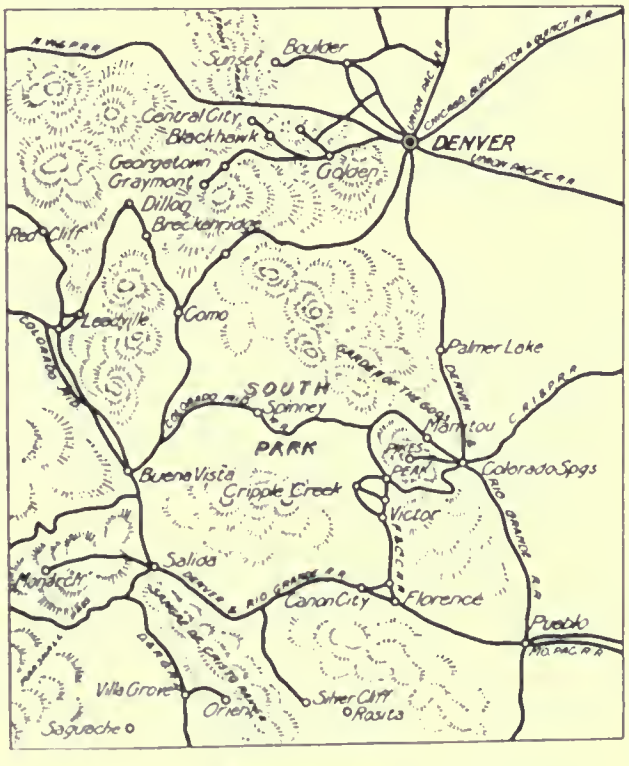
The City of Colorado Springs has given notice to all the industrial plants outside the city limits that by April at the latest they must obtain their water supply from outside sources. This will affect the big reduction plants especially. It was only after much consideration that the City adopted this course. Colorado Springs is growing so rapidly that in case of a serious fire under the present conditions the water-supply would be inadequate and the City would be liable for damages.

The latest development in the struggle for the control of the Portland Gold Mining company is the demand of J. F. Burns, made to the State Commissioner of Mines, that Deputy Inspector McCarty be removed from office. Inattention to duty and an unfair report about the Portland mine are the charges.

The Aspen district is showing renewed activity in prospecting and development work. The Smuggler and Durant mines have kept their pumps going and a small number of miners at work ever since the shut-down on December 7. These mines are now increasing their working force and are ready to start as soon as the market warrants. The machinery necessary to complete the mill at the Ruby mine is on its way. Everything is being made ready for extensive operations on this property in the spring. The Balarat-Smuggler mine at Boulder is being re-opened by H. S. Vaughn and associates of Denver. The property has been purchased for $100,000. This mine has been idle for several years, although it was once a famous producer of lead-silver ore. Men are now at work clearing out the mine and repairing the buildings. The Empire Zinc plant at Canon City has been closed until the market for spelter improves.

The Gold Sovereign Mining & Tunnel Co. of Cripple Creek is getting affairs badly mixed up. Litigation is now threatened by the Franklin Mining Co. of Denver. The deposed Rapp management gave a three-year lease to this company. The stockholders rescinded the acts of the Rapp management at their recent meeting and the new board of directors has given a two-year lease to the Colorado State Investment Co. In its endeavor to escape from poor management, the company seems about to be involved in litigation which may prove worse. The success attending the leasing system in the Cripple Creek district has made the lessees particular. They hesitate to take a lease that does not show ore in plain view. On the other hand, the owners are increasing the royalties. The El Paso Consolidated is finding itself in this difficulty. The lessees who have been awarded blocks of ground are for the most part ready to give up their leases because of the poor showings and the almost prohibitive royalties. Every mine in Cripple Creek is now operating with a full force of men, and it is the first time in many months that idle miners could be found in this district. The great influx of miners from Nevada has caused the executive committee of the Mine Operators' Association to be very watchful and they are now personally examining and passing on all applications for recommendation cards.

Dividends of record paid by mines of the Cripple Creek district amounted to $1,129,145, with an additional estimated earning of close companies of $250,000 for the year 1907. The production for the year was 608,459 tons, valued at $13,148,152, bringing the total value to the beginning of 1908 to $232,793,443. After the fire at the Golden Cycle mill, the output of the low-grade properties suffered, but December showed a large improvement, there being a net gain over November of nearly



A Part of Colorado.

6000 tons, and a profit of $100,000. With the new treatment charges from the smelters, and the resumption of the Golden Cycle mill the new year opens cheerfully. The number of men employed is at high-water mark, and the payroll for December was the largest in many months; there is a surplus of labor, although much new development work is under way, and many of the new comers are turning their attention to leasing. The Eagle Ore Co. is employing two shifts of millmen, handling an average of 800 tons per day. The record for an 8-hr. run at this sampler was broken on the 7th, when 510 tons of ore were handled. The Taylor & Brunton sampler is operating steadily on one shift, with frequent overtime runs.—— The Stratton's Independence, Ltd., Co.'s cyanide plant is under cover, and machinery is arriving daily, a very businesslike activity prevailing; a trial run will probably be made in March, depending on the prompt arrival of machinery.—— The Cresson property on Raven hill reports a strike of high-grade ore, from which shipments returned $10.50 per lb. on several hundred pounds; the strike is of interest also owing to the unusual character of the formation, being in granite in a region noted for its phonolite and porphyry. The Cresson has some large ore-shoots, and the new one appears to be as persistent as the others.

Concentrates.

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

A FRESH WORLD'S RECORD for vertical shaft-sinking with hand labor was created in July, 1907, at No. 2 shaft of the Brakpan Mines Co., Transvaal; the shaft was sunk 201 ft. during the month.

THE most practical method for examining the quality of finished concrete work is by sampling the material by taking out a core with what is known as a shot-drill. With a small hand-power outfit, a hole can be bored into the concrete very rapidly, a core removed, analyzed, and the character of the mixture accurately determined; the holes can be easily filled and do not injure the strength or appearance of the work.

A METHOD for the extraction of petroleum from boreholes that is used by the Galician Carpathian Petroleum Co. at Kryg, in Galicia, consists of passing a continuous band of rope through the borehole; this absorbs the oil, and the saturated portion of the rope is then compressed between cylinders or rolls at the surface. The hemp-band employed is similar to a mine-cage cable, covered with a fibrous material to make it permeable to liquid. It is in three sections, jointed by stitching with shoemakers' waxed thread, which facilitates repairs. It is 80 mm. wide and 8 mm. thick. At Kryg, owing to local circumstances, the apparatus is worked by hand. The amount of oil poured into the tank by compressing the rope is about 415 gm. per current metre. It is said that the method can be utilized for acid-solutions, brine, or even drainage of mines.

To prevent the occasional occurrence of fire in air-compressor cylinders, due to oxidation of the oil used in lubricating, these cylinders should be cleaned frequently. This may be done by filling the oil-cup with soap-suds made of one part of soft soap to fifteen parts of water; the compressor may work a few hours, during which the solution should be liberally fed; then open the receiver blow-off and drain off the accumulation of oil and water. Care should be taken to feed with oil a half hour before shutting down, so that the parts may not be subject to rust. The intervals at which this cleaning process should be repeated depend on the service of the compressor. If on a light load and running for 8 to 10 hr. per day, once every month or two will be sufficient; but if running at full capacity for 24 hr. per day, about once every week or two is necessary.

THE commercial value of asbestos is determined by the strength of the fibre and by its length. Common varieties from localities in the United States are usually brittle, being easily broken in the fingers, while the best quality of Canadian chrysotile asbestos is tough and can be broken only with difficulty. If of the latter quality, a large deposit 20 miles from a railroad in the United States would have commercial value if occurring under average conditions as to mining and hauling to the railroad; but the 20-mile wagon-haul would prohibit the profitable working of a deposit of medium quality. The market quotations are for prepared asbestos. The preparation is expensive and requires a costly plant. Although asbestos occurs in many places in the United States, very little has been mined. The Hance Asbestos Co. in 1905 and 1906 worked a deposit at the bottom of the Grand Canyon in Arizona, and the American Asbestos Co. produced in 1906 a small amount of amphibole asbestos from its mines near Chestnut Fork postoffice, in Virginia. Canada yields by far the largest proportion of the world's production of chrysotile asbestos. The principal deposits are at Black Lake, Thetford, Templeton, Danville, and East Broughton, in Quebec. Italy, Russia, and South Africa produce some asbestos, but all of it is inferior to the Canadian.

A PARTICLE of placer gold, if flaky in shape, may be exceedingly light in weight and yet be readily seen against the black iron of a gold-pan. Near the mouth of the Torio river on the Pacific coast of the Isthmus of Panama, there is a deposit of beach gravel several acres in extent, which contains many exceedingly fine colors of gold. They are distributed with comparative uniformity; each panful of gravel yields about 200, as has been determined by occasional counting. About 1200 colors were weighed and found to aggregate only two cents in value; at this rate 60,000 colors would be required to make one dollar. The display of this flaky gold in the pan might lead the unwary prospector to think he had found a valuable placer deposit; in truth, the gravel probably contains a value of only 40c. per cu. yd., and on account of limited size, character of the gold grains, and other conditions, cannot be profitably worked.

BENZINE is used at the Komata Reefs mine, in New Zealand, in the place of the usual blacksmith forge for drill-sharpening. The storage-tank is situated in the mouth of a disused adit, about 100 ft. above the smithy, and this head gives ample pressure. The furnace, which is rectangular in shape, is in outside measurements about 32 in. long, 12 in. high, and 6 in. wide. It is made of cast-iron plates lined with ordinary firebrick. A Cary burner is placed at one end of the furnace and the blast is directed longitudinally through its centre; an opening at the other end is fitted with a 1½-in. pipe for carrying off the products of combustion. The furnace takes 18 drills on each side; they are introduced through slots and supported on light iron stands. The cold steel is put in at the end farthest removed from the burner and is gradually moved toward the other end as the heated drills are taken out. An average of 2700 drills sharpened during two shifts with three men on each shift has been attained. Either a 1¾ or 2-in. burner is used and the benzine-consumption is approximately 1 gal. per hr. This furnace has given no trouble although it has been running nearly two years.

A SIMPLE method by which the presence of tungsten in a rock may be determined is as follows: The ore should be ground to a fine powder; when it is of low-grade material the tungsten mineral should first be concentrated by washing away the lighter portion, as in panning gold ore, which is not difficult as the tungsten minerals are all heavy; then the concentrate can be dried and ground until fine. Some of the powder is then placed in a test-tube, hydrochloric acid is added, and the contents of the tube are boiled for a short time. If scheelite is present it will be sufficiently decomposed in one or two minutes, but wolframite and hubnerite may require boiling for five or ten minutes. If tungsten is present it is liberated as a yellow precipitate of tungstic acid. Frequently the precipitate assumes an olive-green color. Even when a yellow precipitate is present it cannot be relied upon as a test for tungsten as it sometimes consists of ferric chloride. Having boiled the contents of the tube for a few minutes, remove from the source of heat and add a little granulated tin, or a piece of tin-foil rolled up; this immediately commences to dissolve, and if tungsten be present the solution will within a minute or two assume a beautiful deep blue color.

Discussion.

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy.

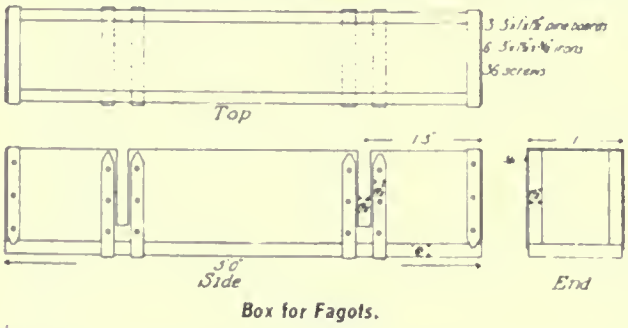
Use of Brush as Fuel in Roasting.

The Editor:

Sir—The photograph illustrates a load of brush fagots or *monojos*, as the Mexicans call them. To a great extent we have substituted these for first-class wood in firing our boilers, and are using them entirely as fuel in our hand reverberatory roasting furnaces. Our first-

Unloading Fagots at the Roaster of the Progresso Mining Company.

class wood costs about P11 per cord of 3.624 cu. m., delivered in the *hacienda*, and we effect a saving of about 20% in cost of fuel by using the fagots in roasting. Besides effecting this saving, the source of our fuel supply



Box for Fagots.

is greatly increased, as there is a heavy growth of *Uno de Gato*, *Palo Arco*, and various other kinds of brush in the immediate vicinity of the *hacienda*. It is advantageous also to clear the ground and give the grass a better chance to grow, giving the freight mules more freedom in grazing, besides being a safeguard against fires, which are rather frequent.

The brush can be burnt very green and gives a long flame, and is not as likely to burn out the grate-bars as is the case with the first-class wood, which makes very hot coals. The fagots are made as follows: Two pieces of fibre plant, such as *heniquen* or *datil*, are placed in the slots in the box, which is shown in the drawing. Then two short rawhide ropes, with iron rings on the ends, are laid across the slots. The brush is then jammed into the box and cinched at both ends (with the rawhide ropes) into compact fagots, and tied firmly with the fibre leaf. It is pulled out of the box, the ropes taken off, and is ready for use.

These fagots are made by contract at two centavos apiece, and we have 50 men employed at this work. Since the drawing was made, we have made a slight change in the design of the box, by using 2-in. planks, instead of 1½-in., and re-enforcing the boxes with 1 by 4-in. strips of wood, instead of with iron straps. Size of box inside is 9 in. wide by 12 in. high and 5 ft. long.

ARTHUR C. NAHL.

Triunfo, Baja California, December 23.

Iron Screen in Zinc-Boxes.

The Editor:

Sir—It will probably create some surprise among cyanide men to be told that iron screens in zinc-boxes are detrimental in as much as they facilitate solution of zinc both by cyanide and caustic soda. Some time ago I attempted to form sodium-zincate by dissolving zinc shaving in caustic soda. The action was not as rapid as I wished and expected, and on consulting Bloxam I found that contact with iron increased the rapidity of action. A simple test demonstrated this to my entire satisfaction. The action was increased a hundred fold.

The question instantly occurred to me: "Why use iron screens in zinc-boxes? There is always more or less caustic soda present." I have since run parallel boxes with and without iron screens. Conditions were maintained as nearly identical as possible with that exception. The results show a saving in free cyanide, as well as zinc. Average analyses over a considerable period show as 0.08 lb. cyanide and 0.05 lb. zinc per ton of solution in favor of new iron screens. It remains to find a satisfactory substitute. I used for the test burlap, perforated zinc sheet, and cocoa matting. None of these are satisfactory for permanent use. Perforated fibre-board would probably fill the bill.

The idea may not have a wide application, but where solutions contain as high as 0.1 to 0.125% free cyanide, it is well worth considering. I quote E. M. Hamilton in saying: "The principle has been proven beyond doubt."

JAMES S. COLBATH.

Torres, Mexico, November 16.

Cyanidation in Nevada.

The Editor:

Sir—The article by Mr. R. S. Browne in your issue of November 30 brings up a subject of extreme interest at this time when smelter rates have been raised so high and settlements deferred so long as practically to prohibit the shipment of ore, and it is to be hoped that those metallurgists who have studied the Goldfield ores will publish such data as they may have, that methods of treatment will be brought forward and compared, to the end that properly designed mills may be erected and independence from the smelters established.

In furtherance of this idea I am pleased to give some

data on tests recently concluded on ores furnished me by the Goldfield Con. Mines Co. and to outline the method of treatment that appeals to me as most economical.

The ore was the characteristic sulphide ore of the Mohawk vein, being very silicious and carrying about 8% sulphides finely disseminated throughout the matrix. These sulphides, besides the iron pyrite, contained tellurium in appreciable quantity, arsenic, and traces of copper. [Since writing the above I see that Mr. E. A. Collins questions the presence of tellurium. I can state for his information that in these samples the tellurium was determined positively by chemical analysis. Also that on a notable shipment of Bonanza ore the analysis showed 2.42% tellurium and 2.00% gold indicating the mineral calaverite, and I have reason to believe that the greater part of the gold in the low-grade sulphide ore is present as a telluride.]

Former tests upon the oxidized ores had given 94% extraction by simple fine grinding and agitation (as shown in a former article in your issue of August 25, 1906), and with this idea in view a portion of the ore was ground to 150 mesh, properly neutralized and agitated with 0.25% KCN solution. The extraction, however, was so poor that further efforts in this direction were abandoned.

A series of tests was then made using what Mr. Browne has seen fit to term the Nevada wet method, that is, the ore was ground to 40 mesh, amalgamated and then concentrated, the tailing was re-ground to 150 mesh, again concentrated, and passed to agitators with 0.25% KCN solution.

The results of these tests varied considerably and depended upon most careful and perfect concentration. The best results obtained by this method showed a final extraction of 92% on ore assaying 2.5 oz. gold, worth $51.67 per ton, distributed as follows:

	—Per ton of ore.— Oz.	Value.	Per- centage.
By amalgamation	0.108	$2.16	4.20
By first concentration on 40 mesh obtained 6.43% worth $398.07 per ton of concentrate, equal to		25.60	49.54
By second concentration on 150 mesh obtained 2.5% concentrate worth $188.07 per ton of concentrate, equal to		4.70	9.09
By cyanidation		15.08	29.18

Cyanide consumption 2.6 lb. per ton. Residue assay, 4.13.

The difficulty of getting regularly the perfect concentration so necessary to the success of this process, led to tests by roasting. A number of tests were made crushing to 10 mesh, roasting, and leaching. These showed extractions as high as 87.5% with a cyanide consumption of 1.6 lb. per ton. The ore in roasting lost 13% by weight.

The next tests were to re-grind to 30 mesh after roasting at 10 mesh and then amalgamating, concentrating any heavy oxides, and leaching the tailing with cyanide solution. Some of these tests gave good results, the best extractions being as follows:

Roasted heading assayed 2.82 oz. gold, worth $58.29.

	—10 mesh.— Extracted.	%	—30 mesh.— Extracted.	%
By amalgamation	$18.40	31.56	$26.04	44.67
" concentration	3.24	5.56	9.35	16.04
" cyanidation	32.50	56.80	21.25	36.46
Total extraction		93.92		97.17

Residues assay $4.13 on the 10 mesh, and $1.65 on the 30 mesh.

These were given four days leaching.

Another test without amalgamation and concentration, but re-grinding the roasted 10 mesh to 30 mesh, gave equally good results by direct cynanidation, the extraction being 97.2 per cent.

While these tests as regards extraction were all that could be desired, considerable trouble in leaching was encountered. The slime formed in re-grinding caused extremely slow percolation and a tendency to channel, and many of the tests showed great irregularity from this cause. It was evident that in practice it would be necessary to separate slime from sand and as this would complicate the plant, further tests were made by re-grinding the roasted 10-mesh ore to slime or to pass 80, 100, and 150-mesh screen, agitating in 0.25% KCN solution for 12 hours and obtaining the following extractions:

Ground to 80 mesh	95.8 %
" 100 "	97.6 "
" 150 "	96.4 "

KCN consumption being 2.0 lb. per ton of ore.

These last results were so regular and so satisfactory that unless mechanical difficulties, high costs, or other objections were found, I should consider it by all odds the best method of treatment.

Let us then consider the mechanical arrangement necessary for such a method of treatment and see if there are any well founded objections too serious to overcome. Such a scheme of treatment involves:

1. Coarse crushing in breakers.
2. Drying the ore. (This may not be necessary when grinding to 10 mesh.)
3. Dry crushing to 10 mesh.
4. Roasting.
5. Re-grinding to 100 mesh.
6. Agitating.
7. Filtering solutions.

The bugaboo of dry crushing and the prejudices against it are readily excusable if one considers the many attempts with the old jarring rolls and the endless trouble with screens and elevators, not to speak of the dust nuisance. But improvement in dry-grinding machinery has kept pace with other metallurgical improvements, and as we have taken from the cement works the tube-mill, so may we find there our intermediate grinder. I refer to a new class of ball-mill called the kominuter manufactured by F. L. Smidth & Co. This mill has been successfully used in many of our new cement plants. Their large capacity per horsepower consumed cannot be equalled by the best of our stamp-mills crushing wet to the same mesh, and, being self-contained, the dust is almost negligible and easily controlled. In one large cement plant in which these mills have been used for three years the costs for the year 1906 were $0.0107 per bbl. of 380 lb. taking a feed of hard clinker passing 1½-in. ring and grinding to pass a 20-mesh screen.

In a personal communication from Mr. John Tait Milliken, superintendent of the Golden Cycle mill, at Colorado Springs, where four of these machines were installed, he informs me that during the time they ran prior to the fire they obtained a "capacity of 17,000 lb. per hour for each mill when fed with a product that had been reduced by rolls to pass through an opening 1½ in. diam." (revolving screen ¼-in. steel plate). These were No. 66 kominuters and "were equipped with a diagonal slotted screen, size of opening 5/32 by ½ in. No. 8 steel plate. This opening gave a product varying in size from ¼-in. cubes to the finest slimes and when discharging this product at the above-mentioned tonnage, the consumption of power was 50 hp. at a speed of 22 r.p.m., the ball consumption being fourteen 5-in. forged steel balls weighing about 19.5 lb. each per day of 24 hours." Mr. Milliken estimates that "1 man per shift can operate and carefully watch 6 or more of these kominuters," and that the liners will last about 2 years. Mr. R. N. Diggles, metallurgist, who visited the Golden Cycle mill just prior to its destruction, tells me that they gave no difficulty from dust.

With these facts before us, may we not stop and consider before rejecting dry crushing?

The next step in our scheme is roasting. In the past, roasting has had two main objections, high costs due to expense for fuel and labor, and unreliability as regards the product, for cyanidation, above all other processes, requires a perfect roast. The prejudice against roasting is probably due more to imperfect roasting furnaces and the many resultant failures in the past than to any other cause. Many of the furnaces that gave most satisfactory results for smelting failed utterly when tried at the cyanide plant. But there are one or two furnaces that have been perfected in Australia and which are now rapidly finding favor in this country and Mexico. I refer to the Edwards and Merton furnaces.

On samples of roasted concentrate taken from the Edwards furnace at the Eagle-Shawmut mine, in California, the roasts were so perfect that less than a pound of lime was required to neutralize the acidity. This concentrate before roasting carried 35% sulphur and after roasting the calcines contained less than 0.25% sulphur. This was accomplished in a 57 by 6 ft. tilting furnace roasting 9 tons per 24 hours and using 13½ gal. fuel-oil per ton of concentrate.

At the Golden Cycle mill four of these furnaces of the Duplex style were operating most satisfactorily and four additional ones, I understand, are to be added to replace other types formerly used. Mr. Milliken favors me with the following data: "Each furnace has an effective hearth-area of 111 by 13 ft. The average sulphur content of ore fed to furnace is 1.8%. Each of these furnaces had an average capacity for the month of July of 107 tons per day of 24 hours, and required 280 lb. lignite coal per ton of ore roasting down to 0.11% insoluble sulphur, and 0.15% soluble sulphur. For the four furnaces the consumption of power was 15 hp. and required the services of one man per shift of eight hours for firing. So far as we can see from our period of operations the repair should not exceed, under ordinary conditions, five cents per ton."

The Merton furnace has also been quite successful in Australia, but I have no data in regard to it. However, I imagine that the dust lost in a Merton would greatly exceed that of an Edwards, in which it is almost negligible. Certainly the Edwards shows up well and answers all our requirements.

We have still to consider the cost of fuel. I take it that California oil is the cheapest fuel delivered at Goldfield, and though I have heard it stated that oil could not be obtained at any price, I have secured quotations on a two-year contract basis, delivered in carload lots f.o.b. Goldfield, and guaranteeing deliveries at the rate of 150 bbl. per day at $2.75 per barrel. Taking the heat values of lignite coal as used at the Golden Cycle mill, this would mean one-third of a barrel of oil per ton of ore. This is slightly in excess of the amount used at the Eagle-Shawmut on heavy concentrate with the small furnace. Assuming this to be correct, the fuel cost would be about 90c. per ton of ore; 35c. additional should easily cover power, labor, and repairs, or a cost of $1.25 per ton for roasting—which can hardly be considered prohibitive.

From the roasters, after cooling, it will be necessary to re-grind to 100 mesh. For this the choice of machines probably lies between the tube-mill and grinding pans of the Wheeler type. Metallurgists are divided as to which is the most suitable for re-grinding roasted ore. Australian practice seems to favor the pan, but this is probably due to the desire to amalgamate while grinding in order to eliminate the coarse gold. This brings up the question of Viator: "How to treat ores carrying some coarse gold as well as fine gold," as discussed in recent issues of the MINING AND SCIENTIFIC PRESS.

In the discussion on the 'Treatment of Desert Ores,' MINING AND SCIENTIFIC PRESS, August 25, 1906, I then advocated the elimination of amalgamation from the scheme of treatment whenever it was found necessary to fine-grind the ore to obtain the maximum profitable extraction and, to prove my contention, I gave the results of some tests conducted at that time. Since then I have had occasion to test the same thing on many ores and have as yet found no instance where I could not obtain just as high an extraction by fine-grinding to 100 or 150 mesh and direct cyanidation, as the total extraction obtained by both amalgamating and cyaniding. To give a particular example: Last summer I was working on a very rebellious ore containing coarse gold as well as fine gold. The ore consisted of a gangue of quartz containing about 5% arseno-pyrite and considerable arsenious oxide. It resisted all attempts at treatment raw, including amalgamation, concentration, and cyaniding. Roasting was therefore decided upon. After roasting at 10 mesh it was leached for four days, washed, then re-ground to 60 mesh, amalgamated, and concentrated to save any heavy oxides containing value. In this ore some of the gold particles were so coarse that they could be picked up with pincers, but they resisted amalgamation (due to a coating on the gold) and it was found to give a higher extraction when amalgamation followed rather than preceded cyanidation.

By this method the ore assaying 3.67 oz. gold per ton gave a final extraction of 96.1%, the residue assaying 0.15 oz. worth $3.10 with a cyanide consumption of ¾ lb. per ton of ore.

Another test without amalgamation and concentration, but re-grinding the roasted 10-mesh ore to 100 mesh and agitating for 12 hours with 0.25% cyanide solution gave an extraction of 98.8%, the residue assaying 0.045 oz. gold worth $0.92, with a cyanide consumption of 0.4 pounds.

It would seem to me, from these and many other tests, that amalgamation is only an added expense if fine-grinding is to be resorted to, and this being so the tube-mill offers more advantages than the pan, especially for large installations. I should take my cooled ore, feed direct to my tube-mill with full strength cyanide solution, and in the great majority of cases it would be unnecessary to grind finer than 100 mesh to obtain a maximum extraction.

This brings us to the agitators. Of the many means and appliances for agitating slime nothing appeals to me, for cheapness and simplicity, so much as the air-lift pump set in a conical-bottom vat. Under these conditions the air-lift is working at its maximum efficiency, that is, the down-take is practically equal to the up-take. This system is too well known to require description and has been successfuly installed to agitate not only slime but heavy concentrate finely ground. It presents the advantages of having no moving parts and requiring a minimum of power.

From the agitators we come to the subject of filters. At present the vacuum-filters seem to find favor in America and Mexico, though Mr. C. W. Merrill has accomplished wonders with filter-presses at the Homestake.

There are several good vacuum-filters on the market, such as the Moore, Butters, Kelly, and Ridgway, all of which do excellent work and would answer our requirements. But these filters have one serious drawback. As cloth is the filtering material used by them, at the commencement of each charge the filtrate is turbid and in many instances this turbidity persists all through the

operations owing to the presence of a small hole in one or more of the filter-cloths. Also an incrustation of carbonate of lime accumulates on these filter-cloths and this progressively impairs their permeability. For efficient working, therefore, a subsidiary filter has to be used to clarify the solution, and the cloths have to be periodically pickled in acid to remove the lime incrustation.

A machine to which these objections do not apply, and which appeals to me strongly on account of its simple effectiveness and low first cost is the invention of Mr. Bertram Hunt. In its simplest form this consists of an annular chamber, which can be made of concrete, the top of which constitutes the filter surface. This filter surface is Hunt's well-known triangular-slat-sand filter, carefully screened coarse sand being used. The inner and outer peripheral walls of the filter are continued three inches above the surface of the filter and constitute tracks on which a carriage revolves. This carriage has a scraper in front which removes the residue and is followed by a distributor for clean sand and one for the slime. Pipes distributing wash solutions and wash-water follow the carriage round the circle at proper distances. In operation, the pulp is preferably first roughly classified so that a portion of the sand in it is separated in a clean condition and this clean fine sand is fed onto the filter surface by the first distributor immediately behind the scraper and the slimy balance of the pulp follows from the second distributor. In this manner the slime is always distributed over a filter surface of fine clean sand which is continuously renewed and removed. This, being a continuous machine, requires little or no attention after it has once been adjusted as to feed of pulp and speed of carriage, and a small part of the time of one man is all that would be required. A machine 16 ft. in diameter has a rated capacity of 50 tons in 24 hours and requires less than 1 hp. to drive and 4 hp. to maintain the vacuum. The machine complete can be installed for a small fraction of the cost of a machine of intermittent type of equal capacity and has the advantage that sand and slime can be treated together on the same machine and at a less cost for repairs, labor, and power.

This completes our process except the precipitation and refining of the bullion, and in this I would follow the usual custom of zinc-box precipitation.

Let us now make a rough comparison of the dry and wet methods. From the data given, I believe it will be admitted that dry-crushing in kominuters to 10 mesh will be as cheap, if not cheaper, than wet-crushing with stamps, and when it is considered that one of these mills complete, with feeders, liners, and balls, costs less than $4500 f.o.b. factory, the comparison with the stamp-mill and its high cost of erection is still more in its favor. As against the cost of roasting we have the cost of concentration and the additional cost of marketing the concentrate. According to my tests 58% of the assay-value could be saved by a series of reductions and concentrations (and this, owing to the careful adjustments necessary and the close attention required, is not always obtainable in the every-day working of the mill). Of the 58% the smelters will pay but $19.50 per ounce of the gold contained as against $20.67 per ounce if shipped as bullion. This is equivalent to 95% of the value, that is, 5% of the 58% must be deducted from the total recovery of 92%, which reduces it to 89.1%, a total difference in the extraction as compared with the method I propose of 8.5%, which on $50 ore amounts to $4.25 per ton. To this must be added a freight and treatment charge of at least $35 per ton on 8.9% of concentrate, amounting to $3.10 per ton of ore, or a total charge against the wet method of about $7.35 above the actual cost of treating the ore. As against this the principal additional cost by the dry method is the cost of $1.25 for roasting. There is also to be considered the greater capacity of tube-mills grinding 13% less weight (loss in roasting) on material made softer by roasting.

In advocating a process against which such strong prejudices have been entertained, I have felt it incumbent upon me to go quite fully into details.

LOCHIEL M. KING.

San Francisco, December 16.

COPPER PRODUCTION.—The American Smelting & Refining Co. and its affiliated concerns, the American Smelters Securities Co. and the Guggenheim Exploration Co., is a growing factor in the copper world. This is apparent from the following figures of production by the American company's smelters during the past three years:

Year.	Short tons.	Refined copper. Lb.
1907	47,300	91,600,000
1906	42,905	85,810,000
1905	36,476	72,952,000

This copper production has come from custom ore. Had it not been for the reverses to the mining industry in the last quarter of the year the copper output of the Smelters trust would have been well above the 100,000,000-lb. mark. The production of copper from the American company's smelting plants during 1908 should be materially increased, as this year it will get the full benefit of the production from its big Garfield smelter in Utah. This is the only copper smelter now operating in the State, and is now turning out copper at the rate of about 72,000,000 lb. per annum, much of it from the treatment of the Utah Copper Co.'s concentrates. The copper production of the American Smelting & Refining Co. is sold in part by the United Metals Selling Co., but the major portion is sold by the American Smelters Securities Co. direct to the trade.—*Boston News Bureau.*

MAGNESITE MINES OF CALIFORNIA.—The only State in the Union thus far producing magnesite in commercial quantities is California, whose output is about 4000 tons per year. This comes chiefly from the group of veins four miles northeast of Porterville in Tulare county, which are being worked by the Willamette Pulp & Paper Co. The veins occur in a brown serpentine. The American Magnesite Co. in 1906 worked a deposit 32 miles southeast of Livermore. The veins stand out prominently and as they are almost dazzlingly white, they can be seen from the higher hills, miles away. One outcrop is 40 ft. wide and traceable through a distance of several hundred feet. Mining is carried on by means of an open-cut. The Walters magnesite mine on the east side of Pope valley in Napa county has made no production for several years, but with improved transportation facilities might become an important source of this mineral. The veins stand up boldly and can be seen from any part of the valley not hidden by hills. One vein at its widest exposure is 10 ft. thick, of which about 5 ft. is solid white magnesite. In another vein 18 in. to 5 ft. of clear magnesite is exposed. Three of the veins can be definitely traced for distances of 140, 250, and 230 ft., respectively. Besides the mines mentioned there are in California several dozen known magnesite deposits, but most of them are too far distant from railroad lines to be profitably worked.

PROSPECTING at the Napa Consolidated quicksilver mine in 1906 was carried on largely by boring with the Calyx drill. Forty-one holes were bored; the results were unsatisfactory as a whole although some indicated good orebodies and it was proposed to prove these indications by further development.

Puddling a Wet Shaft.

Written for the MINING AND SCIENTIFIC PRESS
By HENRY BOURSIN.

The followiug account of how one mine manager puddled a wet shaft is submitted as being of interest to those who have similar work to do.

The Willow River Mining Co. is operating a drift-gravel mine near the head of Willow river, six miles from the town of Barkerville, in Cariboo district, British Columbia. The pay-gravel in this mine is on, and near, the bedrock in the deep channel of the present stream. The depth to bedrock being 107 ft., and the surface gradient of the valley very flat, the mine is worked through a shaft.

In the autumn of 1905, this three-compartment shaft, 7 by 16 ft. in the clear, had been sunk 91 ft. through gravel, and a few feet into rock; and two tunnels had been run out at that level to exploit the channel. Of course, the bedrock was lost in these tunnels, and, by sinking two blind shafts, or winzes, was found at 13 ft. in the deeper one; but the quantlty of water encountered made it impracticable to determine exactly the depth of the channel by this means. That the main shaft was not deep enough for a drift therefrom to bottom the channel, was the inexplicable error of a former manager, who had drilled the ground with an American well rig to ascertain the position and depth of the channel, and sunk the shaft, presumably, on the data obtained in drilling. The error havlng been dlscovered, it became necessary to sink the shaft deeper, and, the depth of the channel not belng known, the additlonal depth of shaft decided on was 25 feet.

The equipment at this shaft lncludes two 18-in. Cornish pumps, driven by a 28-ft. overshot water-wheel, with 7-ft. breast, and, on November 14, when the work to be described was begun, they were on the maximum (8-ft.) stroke, and running 10 strokes per minute, that is, raising approximately 2000 gal. per minute.

With half the inflow stated, deepening the shaft without puddling would have been exceedingly slow and costly, but with the pumps working nearly to their capacity, the shaft could not have been deepened at all without puddling. There was one of two things to do, namely, either resort to puddling, or cease underground work until the cold weather of winter had materially lessened the inflow of water. Therefore the pump compartments were puddled and the centre compartment sunk dry, as shown in the accompanying plan and section.

The first preparatory work was to overhaul the pumps so as to avoid, as much as possible, delays caused by repairs during puddling and sinking. Then the weight of the pumps was put on the shaft-timbers by yokes placed under the flanges of the pump-column, so that the rock beneath the pumps would have the least possible weight to support.

The underground force was then apportioned into two shifts instead of three, working from 7 A. M. to 11 P. M., to enable the manager personally to direct that part of the work requiring the most care. The men were loyal—none more so—but this was the first puddling any of them had ever done; and, as there seemed to be only one man who believed it could be done there and then, it was up to him to see that it was done exactly as he wanted it; hence, with the exception of time for lunch and supper the manager was down in the hole from about 8 A. M. to 11 P. M. until sinking began.

The rock was favorable, being Cariboo schist, compact, and medium hard; that taken from the sides to make room for the troughs, and the first four feet of sinking, was gadded almost entirely, powder being used only when streaks or bunches too hard to gad were encountered, and not more than ½ in. to a shot. Of course, the amount of powder was increased as it became safe to use it. The under edges of the two-inch planking, placed horizontaly to enclose the improvised sumps and help retain the puddling, were carefully filled, as were all joints. The planking was nailed to posts spiked to the bottom sets. The sawed lagging completing the partitions were 'sniped' to one inch thickness on the points, and a neat mat of burlap nailed on the tips.

It is impossible to clean all the sediment from the bottom of a sump containing 18 to 24 in. of water, and the lagging were 'sniped' so as to be driven to the solid rock, and then nailed to the planking. The bottoms and sides of all puddling spaces were lined with burlap—after the crevices between the rock and lagging, below the troughs, had been calked with the same material. All rock was removed from the clay used in puddling, which was the most tenacious that could be found; it was put in dry (there being no lack of water where it was placed!) and was vigorously worked to an even consistence, and as thick as possible, mainly by tramping. This part of it was hard fast work, so as to stop the water as quickly as possible when once begun. The clay was sent down in gunny-sacks for convenience and quickness in placing it. A gate was made to fit the outlet of the troughs conveying water to the pumps, so as to divert all the water to one pump when necessary.

The puddling, and preparation for it, consumed 22 days, exclusive of delays; the labor cost was $851.75; the number of underground men varied from six to nine; wages per man, from $3.75 to $4.25 per day. The blacksmith and two hoist-men received $4 per day each. As the centre compartment was sunk, puddling and small troughs were put in 16 ft. below the first troughs to catch the splash and spray coming from high in the shaft, and to intercept the water should a leak develop in the puddling above.

The water was lifted from the lower troughs by an Edson diaphragm hand-pump. When the bottom was reached, in 23 days, there was still too much water for one 18-in. pump to handle, so a drift was run out 52 ft. toward the channel; this occupied 17½ days, by which time the water had decreased so that one pump could take it all. The men were then (February 5) put at work enlarging the sump to full size and raising in the shaft. On February 7 one shift distinguished itself by sending up 118 buckets of muck, and the other shifts did nearly as well about this time.

When the sump sets had been put in and lagged, a set nine feet higher was put in and lagged with five and six-inch poles. The bottom of the sump was then cleaned, and boxes for the pumps to stand in were placed by plumbing from the pump-bobs, and braced down to prevent floating. A tight platform was then put on top of the 9-ft. set, and raising continued under No. 1 pump. All the water was diverted to No. 2, and No. 1 was disconnected, overhauled, and made ready for lowering.

The rock was broken out under No. 1 on February 17, and the lowering of that pump and making the pump-column and spear-rod connections, etc., occupied seven shifts. With No. 1 taking all the water on the 6-ft. stroke, No. 2 was disconnected, overhauled, and made ready for lowering, and the men began taking out rock under No. 2, timbering as they raised. On March 2, No. 2 pump had been lowered, all connections made, the shaft timbered, and both pumps were working slowly on the 1-ft. stroke. The shaft-sinking and raising, and pump-work occupied 19 days exclusive of delays; the labor-cost was $2286.87. The labor of the whole job cost,

therefore, $3138.62. The cost of explosives, candles, timbers, lagging, and management, would give the total. The drilling was by hand, there being no machine-drill equipment.

One day while sinking was in progress a little dirty water was seen coming from one of the improvised sumps, and one shift of three men put in the shift finding and stopping the leak; with this exception the puddling stood as tight as a bottle, and the only water getting into the little trough was from the splash and spray from high in the shaft.

The men worked in undershirts during the latter part of the shaft-sinking, while driving the tunnel, and all the raising except breaking out.

The work described in the foregoing was designed and managed by Laurent Muller, at that time mine manager for the company mentioned. Considering the difficulties, and how they were met and mastered, it serves as an excellent example of how such work may be done.

RECOVERY OF COPPER FROM NITRATE SOLUTIONS.—Until recently the acid liquors containing nitrate of copper produced in etching the copper rollers used by calico printers have been allowed to run to waste. The recent high price of copper has induced the Calico Printers' Association of England to experiment on the possibility of recovering the copper from these solutions. The method which they have adopted consists in adding metallic lead or litharge to the solutions, so reducing the copper to metallic form and producing nitrate of lead, which is a commercial product of some value. In carrying out the process, the spent solutions, which vary from 1.3 to 1.4 sp. gr., are diluted with an equal volume of boiling water, and during vigorous stirring, lead or litharge is gradually added until no more will dissolve. The clear solution then contains nitrate of lead and copper. It is decanted and allowed to crystallize. The crystals so produced are re-dissolved by boiling in a saturated solution of lead nitrate obtained from a previous operation. The liquor is again allowed to crystallize, when crystals free from copper are obtained. A sheet of lead is then inserted in the liquor that has been used in cleansing the crystals in this way, and the copper is thus thrown down, leaving the solution available again for treating the next set of crystals. The mother liquor from the treatment of the acid with litharge contains nitrate of lead and copper. This is diluted to 1.275 sp. gr. and sheets of lead are inserted in it. After standing for some days all the copper will deposit on the lead. The clear liquor will contain nitrate and nitrite of lead.

PETROLEUM LOCATIONS ON PUBLIC LANDS.—At present petroleum locations are made under the placer law, but the Los Angeles Chamber of Mines desires that changes be made in this law as applied to petroleum claims. It recommends that 160 acres of land be considered a petroleum claim, and that only this amount of land be open to a single individual; drilling for oil is to begin within 90 days from the date of the location, and shall be diligently continued until a discovery of oil is made. Then application for a deed to the land under the present Government regulations shall be allowed. Another provision which the chamber desires adopted is that a prospector be permitted to pay $1 per acre rent on his holdings in place of doing actual development; this is to assure his right to the land for a period not exceeding one year. The intent of these recommendations is to render the prospector secure from having his territory usurped by homesteaders or mineral claimants before actual discovery of oil.

Decisions Relating to Mining.

Specially reported for the MINING AND SCIENTIFIC PRESS.

A person located a placer claim, and subsequently received a patent for a lode claim, which was located so as to conflict with the placer claim. Thereafter he sold and conveyed by deed a portion of such lode claim, and the deed was held to convey so much of the placer claim as was within the part of the lode claim conveyed by the deed.

Collins *v.* McKay, (Mont.) 92 Pac. 295, Nov., '07.

Where the land intended to be conveyed by a deed to a part of a mining claim could be identified, it was held to be immaterial by what name the grantor described the property in the deed. And as between the parties to a deed to a part of a lode claim described by name, it was immaterial whether the location was a valid one as against others or not.

Collins *v.* McKay, (Mont.) 92 Pac. 295, Nov., '07.

Where a deed conveyed a portion of a mining claim, describing it by a particular name, the purpose of the name was to identify the property; and the presumption of law is that the grantor intended to pass the best title he had in the premises.

Collins *v.* McKay, (Mont.) 92 Pac. 295, Nov., '07.

The owner of a coal vein leased the same for mining for one year and as long thereafter as the lessee should continue to mine the same; the lessor was to receive 10 cents per ton for all coal mined, payable at the end of each 30 days; the mining to begin the next day. On failure to begin mining for two years and three months, it was held that equity would cancel the lease at the suit of the lessor.

Starn *v.* Huffman, (W. Va.) 59 Southeast. 179, Oct., '07.

The words "necessary to hold claims" in the statute providing that the certificate of location and of labor and improvement need not be sworn to, did not refer to "certificates of location," but only to the words "labor and improvements," which referred to the statute requiring the expenditure of $100 annually in labor and improvements in order to hold a mining claim prior to the issuance of patent.

Ford *v.* Campbell, (Nev.) 92 Pac. 206, Nov., '07.

A mining claim was located and the locator performed certain work which on survey was discovered to be on conflicting territory, whereupon the locator posted a re-location notice to the effect that such work had been abandoned. The first notice was not removed from the location monument, and the notice of re-location stated that the claim was re-located in order to better describe the place of the lode claim. These facts were held insufficient to indicate an abandonment of the rights under the prior location.

Ford *v.* Campbell, (Nev.) 92 Pac. 205, Nov., '07.

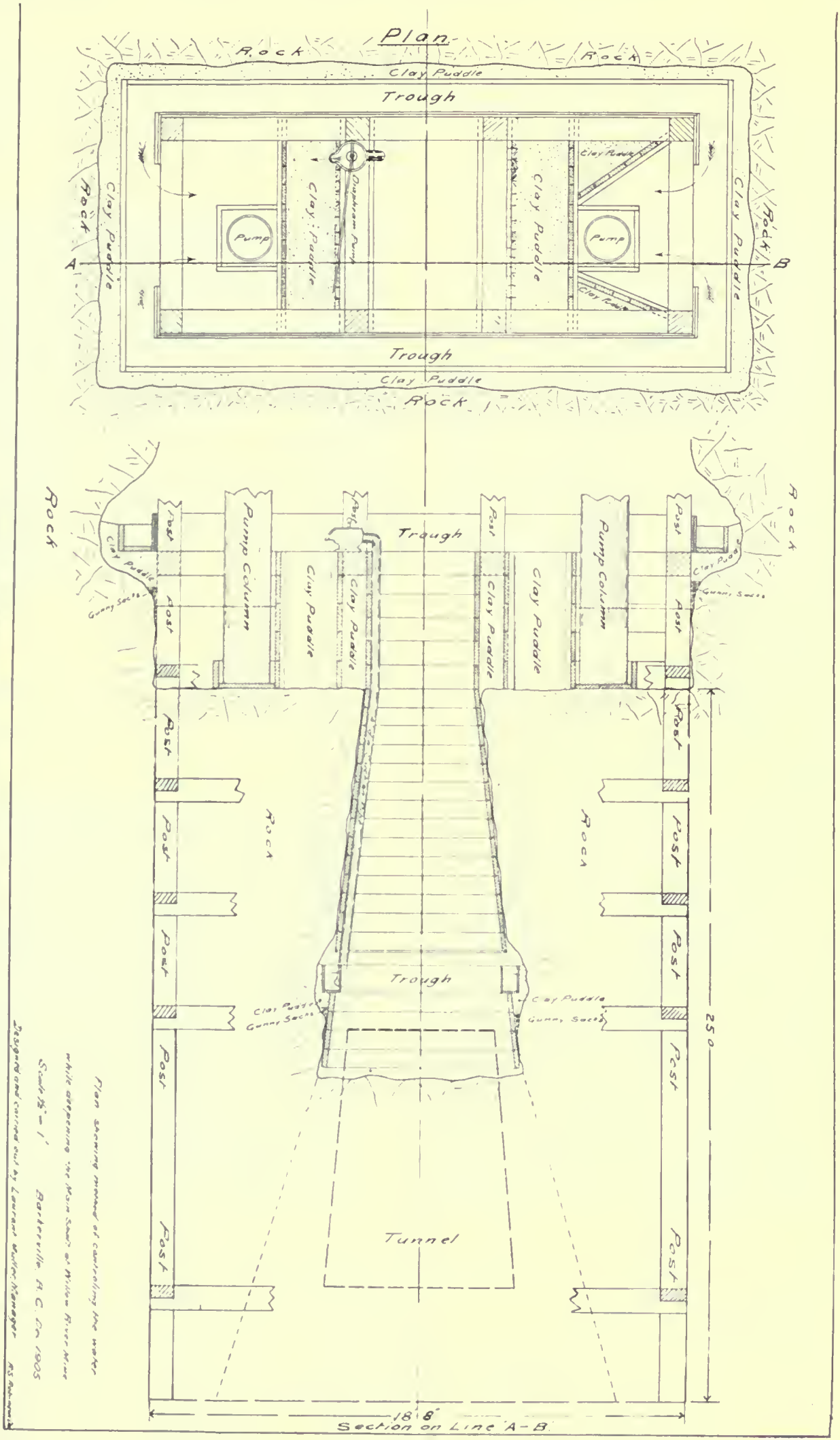
The senior location was held to take the entire width of the vein on its dip, where the apex of such vein was partly within two or more adjacent lode mining claims.

Lawson *v.* United States Co., 28 Superior Court Reporter 15, Oct., '07.

In mining leases, giving the lessor a share of the product or a tonnage of ore or other product, even where there is no covenant to begin work within a certain time, there is an implied covenant to begin in a reasonable time, because the consideration in contemplation of both parties otherwise fails. This rule prevails where no time is fixed in the lease for the work to begin, where it appears from the lease that time was the essence of the contract; and under the further rule that in such contracts where no time is expressed, the law implies a promise to perform within a reasonable time.

Starn *v.* Huffman, (W. Va.) 59 Southeast. 179, Oct., '07

Puddling a Wet Shaft.


Plan.
Rock
Clay Puddle
Trough
Pump
Clay Puddle
Clay Puddle
Clay Puddle

Mining in Panama.

Written for the MINING AND SCIENTIFIC PRESS
By SCOTT TURNER.

Some mining has probably been carried on in Panama, in a desultory fashion, for over 300 years. Traditions of early production and remains of old workings lead to the belief that at one time a substantial amount of gold was produced, almost entirely by placer mining, during the era of Spanish occupation. At present there is but little activity in mining anywhere in the Republic, the one important property being the well known Darien mine at Cana, 150 miles to the south and east of the city of Panama. This was an *antigua*, re-discovered after a good deal of prospecting; the ore ran well in the upper levels, but is becoming poor with depth, which has led to the use of the caving system of mining, in place of square-setting. There is practically no placer work being done in Panama at this time, although several schemes for dredging have been considered.

Manganese mines on the Atlantic coast produced some ore for shipment to the States, but they have been closed down for several years. These mines were developed by American capital, but became unprofitable. Mining companies have been organized to exploit properties at various points along the present Canal Zone, but they have been failures. The same may be said of the districts west and north of the city of Panama. During the past ten years, four or five attempts have been made by American organizations to operate properties in the province of Veraguas, and while this district has thus far proved disappointing, it is perhaps the most promising place to prospect in the Republic, although that is not claiming much for it.

To reach this district, it is necessary to travel by coasting steamer to Aguadulce or Sona, thence overland to Santiago. The distance from the city of Panama to Aguadulce is about 90 miles, including a six-mile trip up a narrow estuary to the new Government dock that lies about three miles from Aguadulce and Pocri, in the province of Coclé. Three years ago the trip into the interior from this point was an unpleasant one, starting with disembarkation from the steamer into a muddy salt marsh, through which it was necessary to wade, often waist-deep, for a couple of miles. But since the payment by the United States of $10,000,000 for the Canal Zone strip, a good deal of money has been spent—much of it foolishly—in the improvement of highways into the interior, so that now a wide roadway has been built to the water-front, and a straight and level road leads through a flat open country for 12 miles to the Santa Maria river, a swift stream about 250 ft. wide, over which General Jeffries, a professional soldier of fortune, has recently completed a steel-girder bridge. With the exception of some *caliche*, the prevailing soil is red clay, the result of the weathering of the andesite country, which is the principal rock. Some small patches of limestone are reported along the coast, but for over 100 miles, with the exception of a small fossil-bearing bed of sandy shale near Santiago, nothing is to be seen but a vivid red clay; black sand glistens in every gully and ravine. To the left, on the peninsula to the east of Montijo bay, the Boston-Panama company owns 500 square miles of ground on which it is doing some prospecting in a crude way, in the region about Pesé and Los Minas. There is a small company operating near Los Santos.

Numerous streams have to be crossed by ford or ferry, and across the Kanaka river is a novel swinging bridge, the passage of which causes a little flurry among the sluggish pack-horses. This trip from Aguadulce to Santiago is made once each week by ox-cart freighting caravans, but in the wet season transportation of this kind is extremely unreliable, and a pack-train is more expeditious.

Santiago is the terminus of the regular mail service and of the Government telegraph line. It is connected by trail with the ports of Montijo, Sona, and Puerto Mutis, but the Aguadulce route is the most traveled. From Santiago to Cañazas, the country is more broken, as the foothills of the main mountain range that forms the backbone of the country are here encountered. A cart-road, branching to the right a few miles beyond Santiago, leads to the Remance mines, owned by a corporation financed in Scotland. This company has operated for 20 years, developing and stoping a six-foot vein standing nearly vertical. The ore is a hard vitreous quartz, filling a probable fissure in an andesite country, and averages about $7 per ton. The mine has never been a dividend-payer. Stamp-milling was tried, but discarded in favor of dry crushing and cyaniding. The mill has a capacity of 50 tons per day, but the mine is seldom able to supply this amount. The frame of the mill-building is steel; the crushing is done by a jaw-crusher and two sets of rolls; the extraction is about 75%. Half a dozen white men are employed, the underground work being done by native laborers on the contract system. The supply of labor is quite irregular, and frequent shut-downs of two or three months, waiting for roll-shells or other supplies, would seem to indicate rather lax management.

Cañazas, a native village of 400 inhabitants, is situated at an altitude of about 800 ft., and may be considered the centre of the recent mining activity in Veraguas. Five miles to the southeast, at a property known as La Guaca, stand the remains of an old 20-stamp mill, the mortars bearing the name of the Pacific Iron Works. A concrete dam collected water to run the water-wheel, and an old engine and boiler show that auxiliary power was necessary during the dry season. This mine was originally located in 1833, but not worked much until the early 'eighties, when an *arrastre* was constructed. In 1887 a company was formed in New York City to operate the property, and a mill was ordered from San Francisco. Louis Janin Jr. had charge of the mill, which only ran a few weeks. The vein is a flat impregnation zone, slightly rolling, between andesite walls. On the foot-wall is a streak of hard, iron-stained quartz; above this, the silicification decreases and the ore grades gradually into the barren overlying porphyry, the pay-streak averaging about three feet wide, the amount of iron stain being indicative of the degree of silicification and the amount of gold. Several thousand feet of work still stand open, and a good deal of ground was stoped, all operations being carried on through adits. Samples from the old stope-walls gave assays varying from $1 to $65. No work has been done on the property since 1894.

Two miles west of Cañazas, the Detroit-Panama company started operations about three years ago. This company cut a wagon-road from Santiago, brought in an engine and boiler, and some new inventions in the way of coarse and fine crushers and amalgamating devices; as the work was done without reliable technical advice or direction, the mill only ran a short time. The company was floated on the strength of a report of a large deposit of $15 ore, but careful sampling after the mill had been built revealed nothing richer than $2.50, so the project was abandoned. The gold occurs in seams in a jointed andesite, and apparently there is a mountain of low-grade material. While old prospectors had been able to clean up a little bullion by running a diminutive three-stamp mill on ore secured by 'candle-stick mining,' it is

impossible to stope anything rich enough to treat on a large scale.

The district to the north of Cañazas, marked by the two peaks of Viriguas that rise to an altitude of about 3500 ft. and are visible for a radius of 20 or 30 miles, is perhaps the most interesting region in Panama, not as much from any chance of successful mining in the future as from the evidence of work that has been done there in days gone by. Viriguas is about 30 miles from Cañazas, over extremely rough trails, and three good-sized rivers, the Cañazas, Piedra, and San Pablo, must be crossed, together with many smaller streams. This is easy enough during the dry season, which lasts from December to May, but during the rainy season the trip is hazardous. The streams all have their sources in the main Cordilleran range, whose peaks are forever enshrouded in clouds. A heavy rainstorm in the mountains, of which the traveler may know nothing, in a few hours will cause a quiet peaceful stream to become a roaring raging torrent. If the traveler is caught between two streams, he must sit down and smoke, curbing his impatience for perhaps a few hours, perhaps several days, until the water subsides. In the beds of these streams are rounded boulders of granite, brought by floods from the granite core that forms the backbone of the main range. Granite and andesite are the only rocks encountered. The country is steeply rolling, cut with heavily-timbered steep-sided ravines, the ridges being barren of tree or shrub, but covered with long grass that affords excellent grazing for the long-horned sleek cattle that roam at will over the ranges. The export of beef is the only industry that the country has. Once or twice each year the herds are rounded up, driven to some port, and shipped to Panama.

Test-Pits in the Bed of Corutu Creek.

A Prospector's Camp. West Viriguas Creek in the Background.

Open-Cut on Viriguas Peak.

A Ford on San Pablo River.

On the more northerly of the twin Viriguas peaks, the remains of an elaborate system of ditches and reservoirs are visible, and at several points open-cuts and pits show where a good deal of ground was sluiced. Work of this sort was done years ago, all the way from the upper portion of the north side of the peak, to the San Pablo, Tolerica, and Viriguas rivers, which lie about 1500 ft. lower and three or four miles distant. The gravel in the beds

of two creeks, Corutu and Limon, which have their sources on the peak, have been worked for nearly their entire length. Between these two streams and around the peak, the ridges have been worked in spots. The material here, however, is of rather peculiar character, being a stiff, iron-stained, residual clay, and not gravel at all. The method universally employed by the original operators was ground-sluicing, probably through bedrock sluices, most of the ground being so stiff as to necessitate breaking with a pick. As a result, there are large cuts standing open, with their sides often 50 or 60 ft. high and nearly vertical. Nearly all this clay shows some gold in the pan, but not enough to encourage mining on a commercial scale. Along the banks of the streams, small hand *arrastres*, made from granite boulders, are to be seen; they were probably used in cleaning up the black sand.

Within the past five years, two companies have been formed in Michigan to work this placer ground, and to develop a quartz vein at the head of Corutu creek. As is often the case, the directors had the mistaken impression that ground that could not be profitably worked a century ago could be made to pay with modern methods. They neglected to consider that work was formerly done by enslaved natives, the labor costing nothing, and the old methods for this kind of placer work were every bit as efficient as any that could now be applied. Test-pitting and prospecting with open-cuts and a tunnel proved the supposed quartz vein to be an irregular lens of granular chert, lying in andesite, that averaged $1.30 per ton in gold, and all work was abandoned. Several foreign companies have prospected in this region, and, while some traces of copper, lead, and zinc are to be found, nothing of importance has as yet been unearthed.

Three possible sources of the placer gold are apparent. The andesite in the vicinity of the peaks always carries some finely disseminated pyrite, which undergoes surface concentration on a rather rapid scale, as the igneous rock carries no quartz whatever, and weathers easily. Another possible source of gold is the small seams with calcite, quartz, and zeolite minerals, which are sometimes found in the andesite; and occasionally small irregular veins of quartz are found in the unaltered country, all carrying traces of gold.

The petrographic features of the Viriguas district, and, as I have said before, of this whole part of the Republic, are extremely simple. There is but one rock of wide occurrence, and that is an augite-andesite, showing typically as a hard, compact, crystalline rock of blue color and porphyritic texture, with phenocrysts of striated plagioclase feldspar, no quartz, some augite, and always some pyrite. This typical rock grades in alteration phases, through the intermediate stages of green and hard, then gray and soft, spheroidal boulder forms, then a soft red rock still showing a porphyritic texture, to the ultimate stage of the decomposition of all the feldspars and the oxidation of most of the iron, making a deep-red, soft, and talcose rock, with the original texture almost unrecognizable. Some few modifications of this typical rock occur, such as an occasional amygdaloidal form of what is probably a more basic phase, the amygdules being filled with quartz or some hydrous silicate, usually a zeolite. Also, rarely the more acid phase occurs in limited areas, possibly approaching a dacite. One of the most common forms of andesitic weathering is in rounded boulders, of a green color. The surface of these boulders is dark; they show concentric weathering, with shell-like layers, looking, as they lie scattered about, not unlike the concentric basalt bombs of volcanic origin found in the Cinder Buttes region of Idaho. These masses weather out at the surface, or even lie imbedded in the residual clay.

This lithological sameness gives rise to a topographical monotony throughout the entire region, there being no sedimentaries, intrusives, or extrusives to modify the landscape by their differential weathering. Across the broad trunk valleys, and for a radius of 30 miles from an observation point on an exposed peak, the topographic features are seen to be everywhere the same.

Labor, throughout the Veraguas province, is scarce and inefficient. The standard of living is so low that the native has no use for money. The inhabitants are ignorant, speaking broken Spanish, and are indifferent workers. A wheelbarrow is an unsolvable mystery to them, and they gingerly attack a muck-pile with a shovel with about the same motion that a billiard player uses in making a massé shot. Twenty-five cents per day, without board, is the standard wage, and it would be impossible to carry a payroll of any size, as the population in the mountains does not exceed five men to the square mile, with no villages near-by. However, workmen often come as far as 25 miles and work a few days, or at most two or three weeks, to get a little money with which to purchase a new *machete* or a few gallons of *aguardiente*. Considered as a whole, the Republic of Panama does not offer a very attractive field for the prospector or the promoter. Many tales may be heard concerning the richness of spots in inaccessible regions and there is popularly supposed to be rich dirt at the headwaters of the Chagres river, but most of these points have been prospected at one time and another by intelligent prospectors, who deny that any rich fields have been overlooked.

ASSAY OF MERCURY ORE.—The following method of assaying mercury ore is given by Holloway in the *Analyst:* Mix the ore in a crucible with 10 gm. of iron filings, through 60 mesh, and cover with 5 gm. of iron filings through 30 mesh. Set the crucible in a hole in a tin plate or asbestos board in such a way that the bottom of the crucible may be heated by the flame, while the top remains cool. Cover the crucible with two pieces of clean silver foil which have been weighed, and which are of unequal size, the upper piece being the larger. Set on top of the silver covers a copper or metal vessel through which cold water may be passed in order to keep the plates cool. Heat for 20 min., allowing only the bottom of the crucible to become red hot. Cool the crucible, dry, and weigh the covers. If tarry substances appear on the foil, they may be rinsed off with alcohol before drying. The amount of ore to be taken for assay depends upon its richness. For less than 1% of mercury use 2 gm.; between 1 and 2% mercury, use 1 gm., and so on.

GOLD IN ALASKA.—Although gold is universally distributed along the coastal mountains of southeastern Alaska in lodes, and less commonly in placer deposits, there are relatively few localities which show a sufficient concentration of auriferous minerals to make valuable ore-bodies; in these few places the ore is usually low-grade. The possibility of mining such ores, however, is obvious when one considers the available water-power and the favorable means of transportation that the country affords. In the gold-quartz veins or lodes, the gold is found both in the native state and also combined with metallic sulphides, which usually penetrate into the inclosing country rock. These quartz-filled fissures were formed subsequent to the general metamorphism of the coastal mountain range and after the intrusion of the granodiorite; their content is in genetic relation to the intrusive rock.—Alfred H. Brooks.

Progress in Southeastern Alaska.

Mining development in southeastern Alaska during 1907 has been greatest in the Ketchikan district, where several copper mines on Prince of Wales island are being exploited, says Mr. C. W. Wright, of the United States Geological Survey, who has recently returned from Alaska. Mining was actively advanced on this island in the spring and early summer, and considerable low-grade ore was produced each month, but most of the mines suspended operations in September and October, with the fall in the price of copper, and the expected increase in the copper production for 1907 will not be realized. Many of the mines that were forced to discontinue operations were in good condition for profitable production at the time they closed, and at some it was not the price of copper alone that caused suspension, but unfavorable conditions as to labor and transportation.

The copper occurs in the form of chalcopyrite, either in irregular masses associated with magnetite, garnet, and epidote at the contact of intrusive rocks with limestone, as at the Mamie, Mount Andrew, and Jumbo mines, or in the form of lenticular bodies associated with pyrite, quartz, and calcite along shear zones in the slates and greenstones, as at the Niblack and other mines. Developments at the Mamie mine disclosed new orebodies on the lowest level, and considerable ore was ready for extraction in the upper levels at the time operations closed. A similar condition existed at the Mount Andrew mine, where large ore reserves were being developed and plans for more extensive operations had been made. At the Rush & Brown mine the copper deposits were being explored 100 ft. below the present working level, which is 90 ft. in depth, and the results were encouraging. Though the developments at the Jumbo mine and Niblack mine are still being advanced and good orebodies are being opened, shipments have been temporarily suspended. Work has been discontinued for the winter at most of the prospects which gave promise of becoming copper producers.

In the Juneau mining district, to the north, where gold is the predominating metal, there has been a steady advance in mine development. At the Treadwell group, on Douglas island, the use of oil instead of coal has been introduced for the steam-plants, and the capacity of the water-power plants has been increased, thus materially reducing the cost for power. The gold production for 1907 from these mines was less than in 1906. This decrease is attributed to the inefficiency of labor, a condition which has affected the entire region. At the Perseverance mine a 100-stamp mill has been completed and 50 stamps have been in operation most of the summer. Work at the Alaska-Juneau mine was continued from June until November and results similar to those in former years were attained. The Ebner mine suspended operations early in June and the mine has been idle since that time. Some exploratory work was done at Sheep Creek, but no actual mining. At the Eagle River mine developments have been vigorously advanced in search of the main vein, which is displaced by a fault. The developments now show both the character and the amount of this comparatively wide zone of faulting, and the vein is being developed at points further in the mountain, beyond the fault. Considerable interest has been shown in the prospects north of Eagle River, at Yankee Basin and at the head of Cowee creek, where auriferous quartz veins are being explored. The Jualin mine, which was being operated under a lease during the summer, was the only mine in the Berners Bay region where mining was in progress. Except a limited amount of prospecting and small scale operations at the Crystal mine, near Snettisham, no work was done in the mines south of Juneau.

In the Sitka district the only active mining operations during the year have been at the DeGroff mine. At this mine a 4-stamp mill was installed to treat the ore from a gold-quartz vein and some gold was produced.

The Shipment of Supplies and Freight by Rail.

When property is delivered to a railroad company or other common carrier for transportation, the carrier must transport it to its destination with reasonable dispatch at the agreed or published rate, and deliver it to the consignee in the same condition as that in which it was received. If it fails to do so, the carrier must pay the owner, if lost, or compensate him for damage, if any is done. Nevertheless the consignee is generally anxious to receive the goods, and in order that he may do so, the shipper should take certain precautions to ensure correct transmission. And, first, he should see that the property is properly crated to stand transportation, and clearly marked with the name of the consignee and the destination. Next, he should make out (preferably in triplicate on a shipping receipt of the road by which the goods are to go) the name and address of the shipper, the name and destination of the goods, the number of packages or pieces and their weight, and note that they are in good condition when delivered. When the freight agent takes over the property he signs the receipt, which is in evidence of a contract, and, like a note, is good for the property it calls for. It is well to see that the agent checks these quantities and notes the condition of the shipment. In case the goods, as ore, grain, etc., are shipped in carload lots, the shipper before loading should examine the interior of the car, if necessary cover with pieces of board any holes by which the ore may leak out, and, after loading, see, if possible if the doors are locked and sealed by the agent. The shipper should also tack to the car at opposite corners printed cards showing the name of the shipper, the name of the consignee, the destination of the car, and its number. In case freight is wrongly way-billed by the agent, this will serve to correct, or at least to call attention to the error. Through carelessness, thoughtlessness, or ignorance the following mistakes can be made by the agent of the railroad company:

A. Receipting for more freight than has been actually received, or receipting for it as in good condition, when in fact it is in bad order.

B. Way-billing freight to a wrong consignee or destination.

C. Loading freight in one car and way-billing in another.

D. Failure to see that all packages are marked with the name of the consignee or destination.

E. Transferring freight carelessly.

F. Improper loading and crating of freight, and rough handling of the cars when switching.

G. Delivering freight to the wrong person, or without an order from the consignee.

H. Delivering freight to a party who is to receive it, and who has failed to present an order from the party to whom it is consigned.

At the Cariboo hydraulic mine, situated at Bullion in British Columbia, the men work close to the overhanging face of the bank, from which large masses frequently fall, but one of their number is detailed as a lookout; so expert has he become in judging the condition of the face of gravel that ample time is given the men in which to seek protection.

Ore Testing at Salt Lake.

Written for the MINING AND SCIENTIFIC PRESS
By ERNEST GAYFORD.

The testing plant of the General Engineering Co. at Salt Lake City, Utah, is in many respects the most complete and up-to-date establishment of its kind in existence. Although it has only been in active operation a little over a year, it has already been instrumental in solving several metallurgical problems, thus saving thousands of dollars, as compared to attempts to solve similar difficulties in the mill itself.

From the accompanying illustration it will be seen that the main plant is so arranged that tests in carload quantities can be made by any one of the following processes, or by combination of any or all of them:

Amalgamation. (Plates and Pierce amalgamator.)

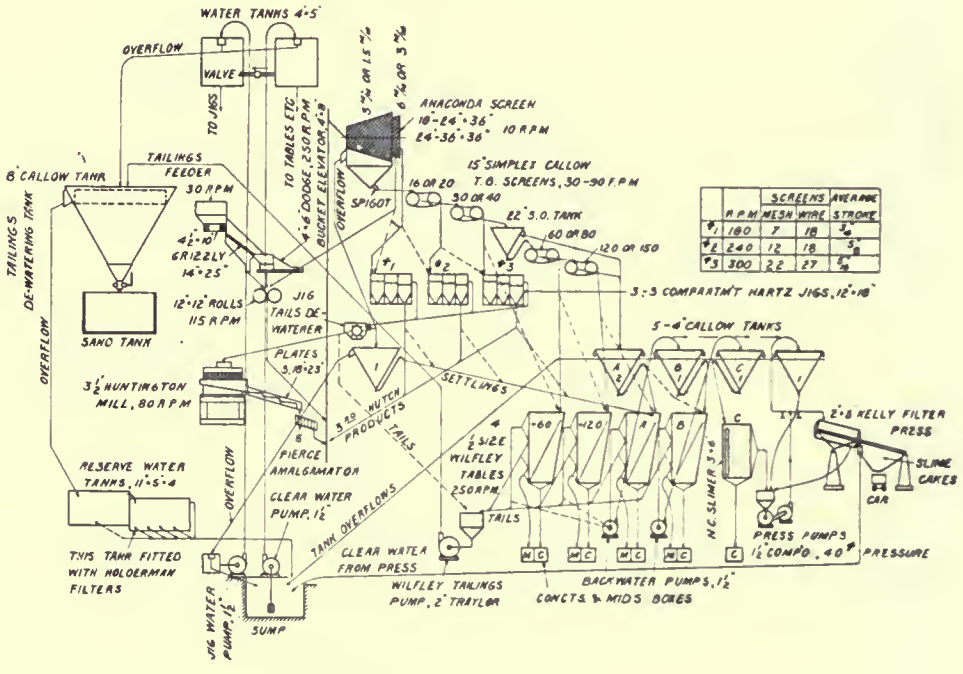
Water concentration. (Jigs and tables.)

Magnetic separation. (Ding's or Wetherill's.)

Cyanidation. (Sand and slime treatment in conjunction with filter-pressing.)

Besides the main plant, which is equipped to handle ore in 10-ton lots, a miniature plant has been installed where all these methods can be adapted to smaller tests of a few hundred pounds each.

From the flow-sheet, it will be seen that in designing the plant J. M. Callow, the president of the company, has carefully borne in mind the need for elasticity in a testing plant, and that products from the different machines can be diverted, by a change of launders or spouting, to their correct destination.



After the material to be treated is once in the feeder at the head of the Dodge crusher it is handled mechanically throughout the whole plant, and no hand-feed, with its inherent errors, is resorted to. The floors, piping, and launders are so arranged that during the operation of a test nothing can escape, all waste material finding its way by gravity either to the sumps or tailing-pump; it is possible thus to account for every pound of feed that has been used, and to ascertain, by actual weights, the proportions of different products into which the ore has been divided.

In the installation of every machine care was taken by the designer that, wherever necessary, accurate time samples could be taken; this is chiefly accomplished by a swinging pipe or launder and a stop-watch; in this way not only can reliable pulp samples be obtained, but also, where wet crushing is employed, the correct proportion of water can be determined, which is one of the most important factors in ore dressing.

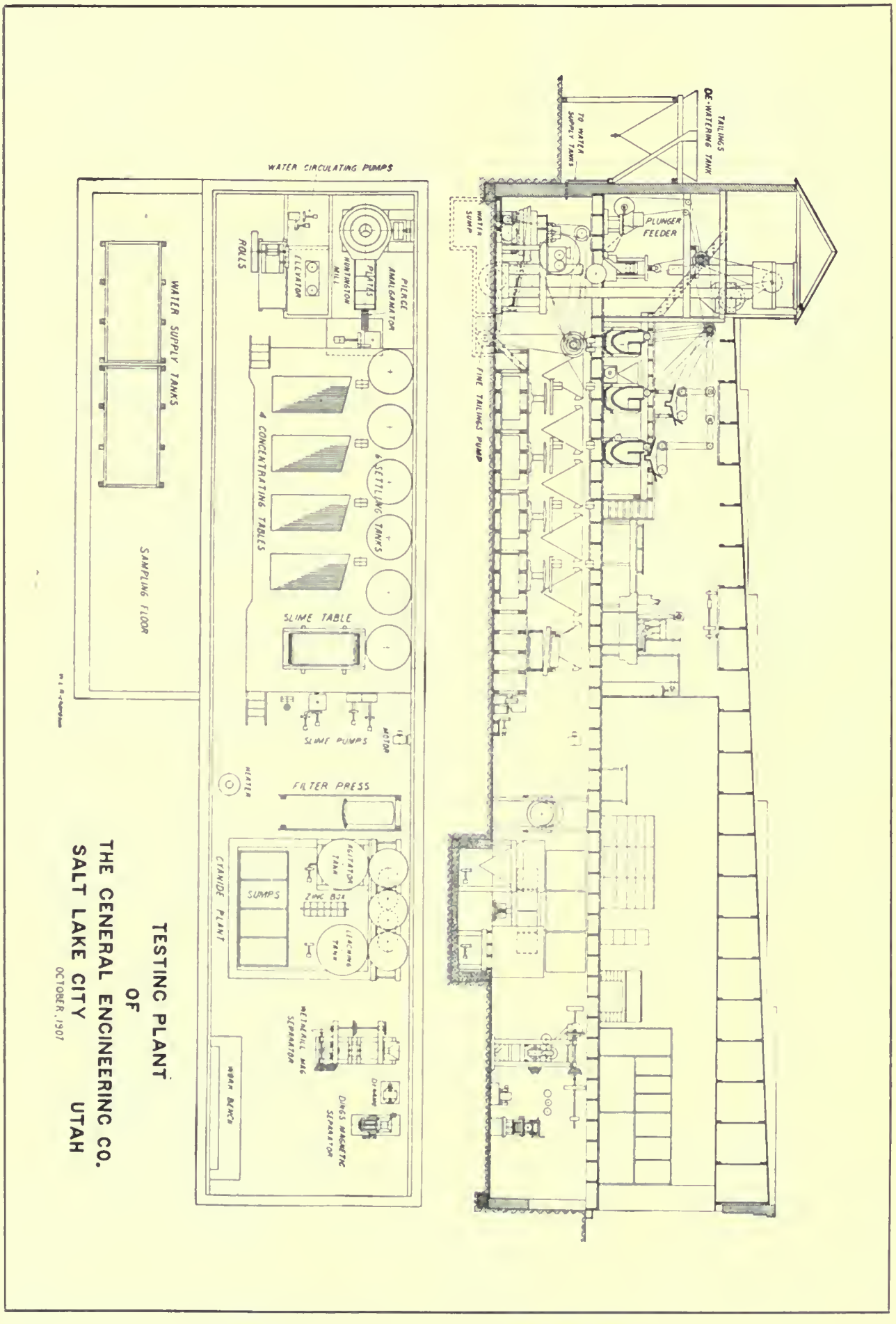
The General Engineering Co. recommends that the carload of test ore should be first sent to a public sampler; this allows not only of a thorough mixing of the material, but also enables an average sample of about 500 lb. to be sacked separately and marked at the sampler. The sampler otherwise handles the car in a manner similar to that pursued had it (the car) been sent them for sale on the open market, a head sample being sent to the shipper, one to the ore-testing plant, and one reserved for reference.

Previous to starting operations in the main testing plant, a series of tests are made in the miniature plant, on the 500 lb. that the sampler has sacked separately, the ore being treated by any number of different methods that its physical nature justifies, accurate weights and samples being taken, results systematically recorded, and comparisons made, with the idea of ascertaining the best metallurgical process for the ore in question, care being taken to give due weight to local conditions at the mine; in other words, the idea is to choose the particular treatment that will yield the highest net returns.

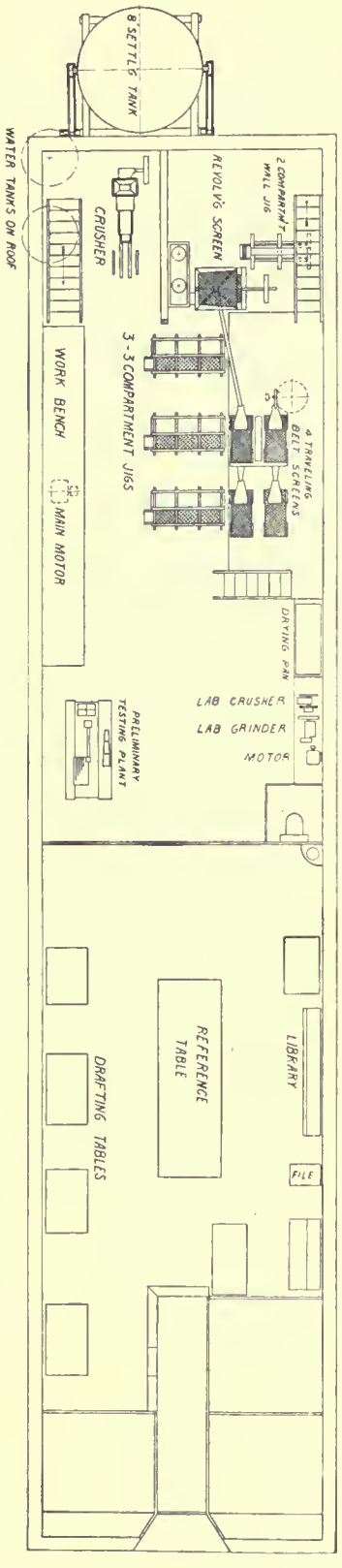
After a careful comparison of the results from the preliminary tests the main plant is adjusted to suit the method chosen and the carload is run through. It is of interest to state that the results from the preliminary tests check closely with those obtained from the carload test, 5% being an extreme variation; this is due to the fact that even in the miniature plant, in which the preliminary work is done, the plate, table, or jig is fed mechanically and not by hand.

The best result in milling does not necessarily mean the highest extraction. Supposing the preliminary work on a carload of test ore showed that by amalgamation, concentration, and cyanidation a 95% extraction could be obtained, but by amalgamation and cyanidation alone only a 90%. The point then to be decided is whether the extra 5% obtained by concentration is going to cost more than it is worth, and if the expense of converting the concentrate into money is going to exceed the yield from such extra extraction. The grade of the ore, local conditions at the mine, and good judgment are the factors employed in reaching a decision.

Again, supposing the ore in question is purely a concentrating ore, the points to be threshed out in the preliminary work would be the initial crushing, where to start jigging and where tabling, what products need recrushing or re-treatment, whether final products be made by gravity methods, or whether a magnetic or chemical process is required before a finished product is made. Here, also, the commercial question comes in; if an 80% saving can be made and a rejection made at each jig, it may be better than an 85% extraction, obtained at the


WATER CIRCULATING PUMPS
WATER SUPPLY TANKS
SAMPLING FLOOR
ROLLS
ELEVATOR
HUNTINGTON MILL
PLATES
PIERCE AMALGAMATOR
CONCENTRATING TABLES
SETTLING TANKS
SLIME TABLE
SLIME PUMPS
MOTOR
HEATER
FILTER PRESS
AGITATOR TANK
ZINC BOX
CLARIFYING TANK
SUMPS
CYANIDE PLANT
WETHERILL MAG. SEPARATOR
DINGS MAGNETIC SEPARATOR
HORSE BARN
TO WATER SUPPLY TANKS
TAILINGS DE-WATERING TANK
WATER SUMP
PLUNGER FEEDER
FINE TAILINGS PUMP
TESTING PLANT
OF
THE GENERAL ENGINEERING CO.
SALT LAKE CITY UTAH
OCTOBER, 1907

expense of re-crushing all the jig tailing instead of a small quantity of jig middling. Further, conditions at the mine may call for a high-grade concentrate and a high ratio of concentration, and while this may have to be obtained at the cost of a small loss in the tailing, the process must not only fit the ore but also the mine from which the ore is taken.



The report sheets employed by the General Engineering Co. (a sample of which is shown in the accompanying cut), while elaborate, are concise, inclusive, and easy for the lay mind to understand, they show the saving of the different minerals at each stage of treatment, the proportion that each saving bears to the total amount of that mineral in the head sample, and finally a number of different combinations are worked back to the actual net returns.

The question is often asked whether results in a testing plant can be duplicated in a mill. Yes, provided the sample on which the test work was done is representative of the ore that will be sent to the mill, that the design of the mill incorporates the system that was found most applicable to the ore in the test, and that when the mill goes into operation it is in charge of some one familiar, at least, with the fundamental principles of ore treatment.

A well-known mining engineer remarked to the writer recently that it was extraordinary, but nevertheless a fact, that no man would think of buying a suit of clothes without first taking the precaution to fit them on, but that the same man might not hesitate to place an order for machinery for a $50,000 mill, and be surprised when it went into operation that it did not fit the ore it was built to treat.

ORE TESTING DEPARTMENT

Lot 10 — THE GENERAL ENGINEERING COMPANY—CONSULTING ENGINEERS
Test 1 — SALT LAKE CITY UTAH — Date ____ 190__
Sheet 3

Assays and Calculations

Of Concentration ____ test ____ ore from ____ Mine ____

Description of test ____

No	SAMPLES	WEIGHTS Tons	ASSAYS Per Ton of Dry Pulp Pb	Zn	Ag	Au	CONTENTS Pb	Zn	Ag	Au	% Total Extraction of Head Sample Pb	Zn	Ag	Au
			SYNOPSIS				100 Ton Basis.							
	Test as run													
	Lead, Samples 2, 3, 4	11.85	27.35	15.35	22.3	.185	323.95	183.01	265.10	2.19	80.44	18.83	31.6	13.78
	Zinc, " 5	24.80	1.20	19.69	10.40	.20	29.54	484.57	255.84	4.92	7.33	49.90	30.5	31.10
	Tails " 6, 7	63.55	0.77	4.78	5.0	.138	49.28	303.82	318.00	8.74	12.23	31.27	37.9	55.12
	Heads	100.00	4.03	9.7	8.39	.159	402.75	971.20	838.94	15.85	100.00	100.00	100.00	100.00
	Combination "1	(½ Cut Experiments)												
	Lead, Samples 2, 8, 4	8.08	36.0	12.5	23.95	.183	290.07	101.00	193.60	1.478	72.05	10.45	23.12	9.27
	Zinc, " 9, 12	14.75	4.18	27.9	13.27	.185	56.60	411.70	225.47	2.734	14.04	42.45	26.98	17.11
	Tails, " 13, 6, 7	77.17	0.73	5.92	5.43	.151	56.09	457.59	419.33	11.680	13.91	47.12	50.00	73.62
	Heads	100.00	4.03	9.71	8.38	.159	402.76	970.95	838.40	15.892	100.00	100.00	100.00	100.00
	Combination "2	(⅓ Cut Experiments)												
	Lead, Samples 2, 10, 4	9.34	30.37	13.58	23.1	.173	283.85	126.45	215.37	1.610	70.41	13.00	25.71	10.12
	Zinc, " 11, 14	10.32	6.80	28.7	15.85	.231	70.23	296.36	163.58	2.386	17.56	30.43	19.53	15.01
	Tails " 15, 6, 7	80.34	0.61	6.86	5.71	.148	49.28	550.8	458.55	11.914	12.23	56.57	54.76	74.87
	Heads	100.00	4.03	9.73	8.37	.159	403.36	973.61	837.48	15.910	100.00	100.00	100.00	100.00
	Combination "3	(½ & ⅓ Cut Exp Combined)												
	Lead, Samples 2, 8, 4	8.08	36.0	12.5	23.95	.183	290.07	101.00	193.60	1.478	72.04	10.45	23.12	9.27
	Zinc, " 9, 14	11.58	5.41	27.7	18.00	.218	63.65	321.19	185.36	2.520	15.73	32.98	22.12	15.86
	Tails, " 15, 6, 7	80.34	0.61	6.84	5.71	.148	49.28	550.8	458.55	11.914	12.23	56.57	54.76	74.87
	Heads	100.00	4.03	9.73	8.37	.159	402.98	973.65	837.49	15.912	100.00	100.00	100.00	100.00
	Combination "4	(⅓ & ½ Cut Exp Combined)												
	Lead, Samples 2, 10, 4	9.34	30.37	13.52	23.1	.173	283.85	126.45	215.37	1.610	70.41	13.00	25.71	10.12
	Zinc, " 11, 12	13.49	4.69	28.7	16.3	.193	63.20	386.65	220.39	2.600	15.68	39.08	24.29	16.26
	Tails " 13, 6, 7	77.17	0.73	5.92	5.43	.151	56.09	457.59	419.33	11.68	13.91	47.12	50.00	73.62
	Heads	100.00	4.03	9.7	8.38	.159	403.14	970.91	838.34	15.89	100.00	100.00	100.00	100.00
	Combination "5	(Jig & Table Concts as run + "1 Zinc from ½ Cut Exp't s.)												
	Lead, Sample 2, 3	9.16	32.4	14.21	23.94	.191	296.53	134.13	219.10	1.762	73.62	13.39	26.13	11.07
	Zinc, " 12	10.98	2.07	30.08	14.06	.184	22.72	330.2	154.37	2.018	5.63	34.08	18.40	12.60
	Tails, "4, 6, 7, 13	89.86	1.05	6.4	5.84	.152	83.52	510.47	465.35	12.110	20.75	52.56	55.47	76.33
	Heads	100.00	4.03	9.71	8.38	.159	402.77	970.87	838.8	15.83	100.00	100.00	100.00	100.00

REMARKS

THE GENERAL ENGINEERING CO

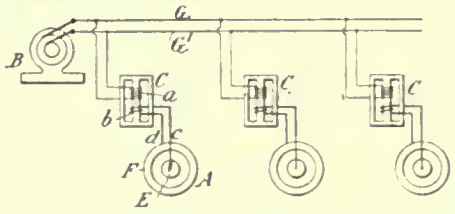
By J. H. Callow

Assays of sea dredgings indicate that the bed of the Atlantic ocean carries appreciable amounts of gold and silver, and that the deep-sea bottom is relatively richer in gold than that nearer the shore-line.

MINING AND METALLURGICAL PATENTS.

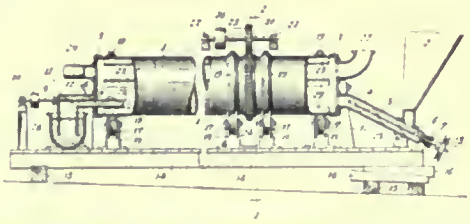
Specially Reported for the MINING AND SCIENTIFIC PRESS.

ART OF ELECTRIC SMELTING.—No. 874,944; Frank Creelman, New York, N. Y.; assignor to The Willson Carbide Works Company of St. Catherines, Limited, St. Catherines, Canada, a Corporation.



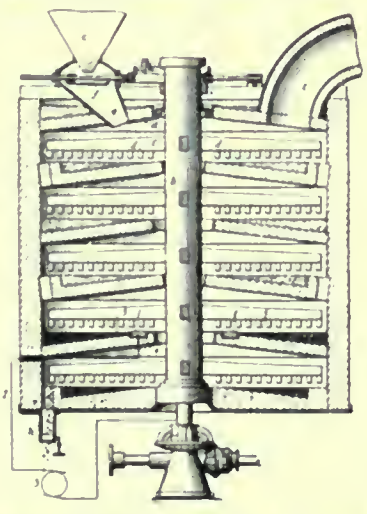
The process of electric smelting which consists in subjecting the material to be smelted to the heat of an electric current of substantially uniform amperage notwithstanding variations in the internal resistance of the furnace, and regulating the furnace to restore the normal internal voltage and maintain an approximately uniform expenditure of energy.

PROCESS FOR TREATING SMELTER SMOKE AND EXTRACTING VALUES FROM ORES OR METALLURGICAL WASTE PRODUCTS.—No. 875,222; Stanley S. Sorensen and George C. Westby, Murray, Utah.



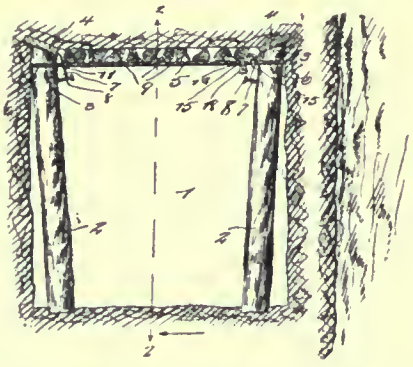
The hereinbefore described process of purifying smelter smoke and extracting values from ores or metallurgical waste products consisting in preparing the materials to be treated by comminuting the same, and then causing sulphurous smoke to come in contact with the materials in the presence of moisture or water while they are being agitated, whereby the valuable bases or metals of the slag are converted into sulphates, thionates, thionites, and sulphites by means of the sulphur dioxides and sulphuric acid of the smoke.

FURNACE FOR DESULPHURIZING AND AGGLOMERATING ORES.—No. 875,331; Andrew J. Dull, Harrisburg, and Joseph Weatherby, Jr., New Cumberland, Pa.; said Weatherby assignor to said Dull.



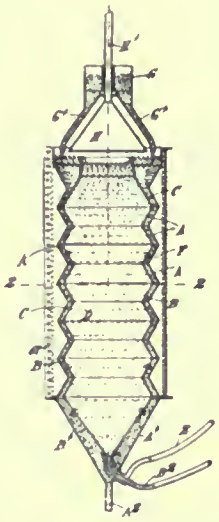
An ore roasting furnace having means for heating the ore to desulphurize the same, an electrode arranged in the furnace, a second movable electrode co-operating with the first-mentioned electrode to produce an electric arc to the action of which the heated ore is subjected, said movable electrode being adapted to move the agglomerated ore beyond the radius of action of the arc

MINE-ROOF SUPPORT.—No. 875,182; Frederick C. Keighley, Uniontown, Pennsylvania.



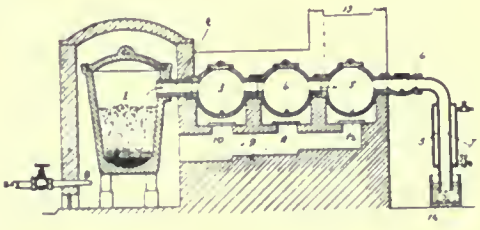
In a roof support for mines, a plurality of standards arranged in opposite rows, timber-supporting means connecting opposite standards, and wedges to prevent downward displacement of said means. In a roof support for mines, a plurality of standards arranged in opposite rows, timber-supporting tie rods or stretchers connecting opposite standards, and wedges to prevent downward displacement of said tie rods or stretchers.

PROCESS FOR THE TREATMENT OF ZINCIFEROUS ORES AND METALLURGICAL PRODUCTS.—No. 875,424; James H. Gillies, Auburn, Victoria, Australia.



An improved process for the treatment of zinciferous ores and metallurgical products consisting essentially of first roasting the ore, second feeding such roasted ore through a current of dilute sulphuric acid moving continuously in an opposite direction, and finally, continuously separating the solution of zinc sulphate from the slimes and undissolved particles by settlement, substantially as described.

PROCESS OF TREATING COMPLEX ORES CONTAINING ZINC AND OTHER VOLATILIZABLE METALS.—No. 875,381; George M. Rice, Worcester, Massachusetts.



In the art of reducing complex zinc ores direct from the raw ore, the process step which consists in supplying to the ore a quantity of finely divided metallic iron in large excess of the amount required to combine with the sulphur from the volatilizable metals in forming monosulphide of iron (FeS) and an additional amount sufficient to form slag, with the silica contained in the ore during the melting operation

Mineral Resources of the United States.

The twenty-third annual volume of the series 'Mineral Resources of the United States,' published by the United States Geological Survey, is now passing through the press. This volume contains a statement of the production of mineral substances during 1906.

Practically the same form of arrangement has been preserved in all of the 22 preceding volumes of the series, and it has become so familiar to the mining fraternity as to render any description unnecessary. But for those to whom this volume comes as a new book of reference it may be explained that the book is divided into chapters, each of which treats of a separate mining industry. The student who consults this report to find a combined statement of the mineral resources of a given State is referred to the tabular statement of output by States in the summary, and to the index, in which, under each State, is a list of the minerals produced therein. The effort is also made to show the conditions of the domestic industry in relation to foreign conditions in the same mineral industry.

It is important, also, for the new reader to know that this volume is simply the consolidation of the separate chapters after they have been published in pamphlet form, frequently months in advance, and that these pamphlet reports, and not the final volume, mark the dates at which the reviews become available. Further, for greater statistical promptness, it is the custom of the Survey to give the principal figures to the public press in advance of the publication of the chapters in pamphlet form.

Several new names appear as the responsible authorities in charge of individual chapters. This is in pursuance of the policy of the Geological Survey announced in the volume for 1905 of assigning all subjects to members of the Survey staff who, in this work and in allied problems, are employed solely in the Government service. The report on iron ores for 1906 was prepared by Edwin C. Eckel, who, in past years, has made a special study of the iron ores of the South. The series of iron ore reports for the United States owes its statistical development entirely to John Birkinbine, of Philadelphia. Under his direction the statistics of iron ore production have been developed to an exceptionally high degree of accuracy. This has been due, fundamentally, to the great confidence given him by iron ore producers, among whom Mr. Birkinbine has developed a spirit of fraternity similar to that which James M. Swank, the general manager of the American Iron & Steel Association, has evoked among the iron and steel manufacturers. The reports on copper, lead, and zinc in preceding years have likewise been developed entirely by Charles Kirchhoff, of *The Iron Age*, New York. These reports have become classic for their statistical accuracy and for their keen and fair analysis of the trade situation. The report on copper for 1906 was made by L. C. Graton, and those on lead and zinc by J. M. Boutwell.

This volume also records the change of the administrative head of the division of Mining and Mineral Resources from David T. Day to Edward W. Parker, Dr. Day devoting his time to the important work of preparing the reports on petroleum and natural gas. The change of administration includes the placing of the statistics of metal production (except iron ores) under the supervision of Waldemar Lindgren, who has, as chief assistants, Charles G. Yale, of San Francisco, Victor C. Heikes, of Salt Lake City, Chester Naramore, of Denver, and Messrs. Boutwell, Graton, McCaskey, and Siebenthal, of Washington. This arrangement has materially strengthened the work of the division. It is designed, also, to supplement the statistical data with the results of geological and chemical research in so far as they pertain to the economic development of our mineral resources. The division of Mining and Mineral Resources has been for some time an integral part of the geologic branch of the Survey, this incorporation having been accomplished when the present plan of organization was adopted.

By way of brief review and summary of the series, it may be said that in the 27 years covered by these 23 reports, the scope of the work has remained practically the same—an annual review of the mineral production of the United States, and of the state of knowledge of the mineral deposits from which the products come. But the work involved has multiplied in two directions. In the beginning the statistical feature of the work was satisfied by an estimate as to the total output of each useful mineral. This estimate was based upon the best commercial estimates available, and the statistical correspondence was limited to a few hundred letters each year. When the control of the work passed into the hands of Dr. Day, he took it with the intention of developing each statistical inquiry from an estimate into an accurate annual census through confidential reports at first hand, as rapidly as facilities would permit. This result has now been achieved with every industry except petroleum, and to this particular and difficult task he will henceforth limit his work. The correspondence necessary for this annual census of the mines of the United States has grown from a few hundred letters to an average of three written or printed communications a year to every known mine operator of the United States, more than 150,000 in all. In order to make such correspondence successful, it has been necessary to send agents to the mines themselves, both for scrutiny of the statistical returns and in order to acquaint the operators with the nature of this inquiry, and thus to secure the co-operation essential to success.

This growth of statistical work would have been necessary even if the mine development had remained stationary. Instead, the rate of increase has been far beyond all reasonable prophecy. In the 27 years from 1880 to 1906, inclusive, the value of the mineral output of the United States has increased over five times. This marvelous growth is of additional interest in that it shows approximately by its fluctuations the financial ebb and flow of the whole country. From $364,928,298 in 1880, the value has risen gradually to the immense sum of $1,902,517,565 in 1906. This is the value of the mineral products in their first marketable condition, as shown in the first large tabular statement of the summary, where all unnecessary duplication is excluded.

It is of interest to note in passing that Pennsylvania produced nearly $600,000,000, or about 30% of the total value of the output of 1906; Ohio about $200,000,000, or 11%; Illinois, $117,000,000, or 6%; New York and West Virginia, $81,000,000, or 4% each; Montana, Colorado, and Michigan, 3.5% each; Arizona and Missouri, 3% each; Alabama and California, 2.5% each. The value of the mineral output of each of the twelve States named was in excess of $50,000,000. If the combined value of output of 11 of these States ($905,000,000) be deducted from the total ($1,902,000,000), the value of output of the twelfth State, Pennsylvania ($583,000,000), exceeds the combined value of output of all the remaining States of the United States by more than $150,000,000. Keeping pace with this growth has been a strain, and it is gratifying that the system has so expanded that the statistics of this wonderful production continually increase in completeness and accuracy. This attainment is largely the result of the hearty co-operation of the producers, due to their faith in the Survey.

In carrying out the plan of co-operation with the other divisions of the geologic branch, a twofold advantage is secured. It brings to the statistical work on the one hand a corps of trained men whose field observations have developed a keen appreciation of the geologic and economic importance of each mineral product. This has been particularly illustrated in the reports made by Mr. Lindgren and other mining geologists on gold and silver in the volume for 1905, and the reports on the same subjects and also on copper, lead, zinc, and quicksilver in the present volume. On the other hand, the mining geologists have obtained and will continue to derive from their statistical work an insight into the industrial and commercial conditions which so largely affect the demand for the different minerals, and lead to the search for, and development of, the mineral deposits with the geological relations of which their field work makes them acquainted. The bringing together of these two classes of study of our mineral resources, that of their geology and manner of occurrence, and that of their statistics and economic conditions, is to be one of the special features of the future work of this division.

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Editorial.

ON ANOTHER PAGE we publish a letter from Mr. Claude Sachs, editor of *The Mining Investor*, criticizing a recent article by Mr. J. H. Curle. It is well that the other side of the case should be stated and while we disagree with the opinions expressed by Mr. Sachs, we appreciate his courtesy in contributing to our columns, and leave Mr. Curle to submit a rebuttal.

MANY of those who read the President's dispatches to the Governor of Nevada will have remarked on their peremptory and rather rough tone: this seemed to be contrary to diplomatic usage. The explanation is: the President knew the Chief Executive of the Sovereign State of Nevada was carrying a load in excess of the factor of safety usually allowed in good engineering practice.

IT IS ESTIMATED that the mines of the Lake Superior region produced 223,800,000 pounds of copper in 1907, as against 228,400,000 pounds the year before. Calumet & Hecla produced about 84,000,000 pounds. Osceola and Tamarack decreased their production, and were the main factors in making the total less than that of 1906. But this is not due to any marked curtailment of output after the price of copper declined toward the close of the year, for it is characteristic of the Lake Superior companies that they pursue the even tenor of their way, while other people take orders from the metal selling agencies and get entangled in market complexities.

BY THE COURTESY of Mr. E. Jacobs, the secretary of the Western Branch of the Canadian Mining Institute, we have received an account of the first meeting of that organization, as held at Nelson, British Columbia, on January 15 and 16. The attendance was good, it was representative, and keenly interested in the proceedings. Mr. Frederic Keffer, the president of the parent Institute, was in the chair. On the first day Mr. A. B. W. Hodges was elected president of the branch association. It was decided to hold three meetings each year. Many new members were elected and it is expected that the organization of the branch will result in a large addition to the membership of the Institute. Owing to the fact that the mining districts of British Columbia are distant from the central points at which the Institute usually meets, it was argued that a local auxiliary organization would be of great service both to the mining industry of British Columbia and to the Institute itself, stimulating both. A good start has been made. We shall watch the experiment with interest, for it may suggest a simi-

lar departure on this side of the boundary, with the formation of a Pacific branch of the American Institute of Mining Engineers.

The Goldfield Strike.

THE march of events in Nevada has been rapid. By request of the Governor of the State, the President ordered Federal troops to Goldfield on December 4; a week later three commissioners were sent from Washington to ascertain the facts; they arrived on December 16, and upon the presentation of their report the President telegraphed to the Governor that the troops would be withdrawn on December 30, unless he called the Legislature in special session to provide means for policing the disturbed district. Thereupon the Legislature was convened for January 14. On the opening of the session a resolution was passed asking the President to permit the troops to remain at Goldfield pending the organization of a State constabulary. The President acquiesced. On January 24 the Nevada Senate passed the bill creating a constabulary, to consist of a force of 250 men, and on the same day a majority in the Assembly voted to request the Mineowners Association of Goldfield to abolish the card system, by which the members of the Western Federation of Miners are proscribed. This demand being accepted, the Assembly passed the bill creating the State constabulary, and it became law by the signature of the Governor. It is recognized now that the operators at Goldfield made a mistake in lowering wages and issuing a ban against the Western Federation at the very moment when the troops arrived; it was this coincidence that led to the Federal investigation. By withdrawing the card system and requiring only a proof of competency and reliability on the part of those applying for work, the operators have recognized the force of public opinion. Black-listing is the complement of boycotting, both are tyrannical and unfair. An employer has the right to refuse to engage any workman he does not want, but he has no right to discriminate against a man on account of his membership in any club, church, or association until such organization has been declared illegal by proper process of law. The open shop is a snare and delusion unless it means the absence of discrimination as between union and non-union men. A man is as much entitled to be a member of a union as an employer has to be a stockholder in a corporation or a member of an operators association. If the mine-owners want to free themselves from the tyrannical interference of the rowdy element in the Western Federation they will do so best by giving fair treatment to those members of the Federation who themselves object to such of their leaders as are responsible for the brutalities and atrocities perpetrated in Colorado, Idaho, and Nevada during the last ten years. By trying to be just and fair, the mine-owners will get the support of public opinion and this in the end will give them more of protection than any constabulary such as is now to be organized. We have no great confidence in this volunteer police. The men are to receive $20 per *week*, a fact worthy of mention in contrast to the $13 per *month* paid to the enlisted men of the regular Army. The higher pay recognizes that the force is to be recruited from among a community accustomed to high wages, but the members of the constabulary will be, like the militia of neighboring States, efficient for defence against a foreign foe but incompetent as a protection against domestic turmoil. They have not the military instinct of the regulars and are half-hearted in their obedience to orders requiring them to proceed against their friends and acquaintances, whether mine operators or mine workers. So, after a brief and unsatisfactory experiment, we expect to see the Governor of Nevada and the Legislature appealing again to Washington for Federal troops and the eventual establishment of an Army post in Nevada.

In the meanwhile conditions at Goldfield are steadily improving. Many miners are returning to work and a few have come into the district from Utah and California. The new arrivals have not been intimidated by the pickets of the Western Federation, for local opinion is opposed to lengthened inactivity at the mines. It is the general belief that 75 per cent of the members of the Federation will be glad to return to work if they can be assured of protection, and the abrogation of the card system will encourage these more desirable men to break away from the extremists. We hope soon to be able to report that the strike at Goldfield is at an end.

Inventions and Patents.

HUMOR is the salt of literature and the savor of it makes digestible even technical contributions. A little of it is as welcome as sunshine after rain, for this is a dreary world and only the man of pleasant fancy and delicate wit can lighten the gloom of industrial depression. At least that is what Mr. Arthur DeW. Foote has done, for his letter on tube-mills and slime-filters is so seasoned with Attic salt that we find even the cyanide process deeply interesting and patents positively funny. All our cyanide experts will chuckle at the simple story he tells and some of them will even be generous enough to see that the joke is against them. The facts are clearly stated and in a courteous manner; no harm is done to anyone; some enlightenment is vouchsafed to those entangled in the battle of the processes; and, finally, a moral is pointed. With that moral we cordially agree. Patents are the outward and visible sign of inward and technical inventiveness, it is in the application of them that they are justified. To fight over priority of patents in a world running over with clever lawyers is to play into the hands of that one-eyed devil of litigation who too often usurps the place of blindfolded justice. If inventors will cease their bickering and set to work to show the managers of mines how to apply their new metallurgical and mechanical ideas, with the adoption of new devices and processes, we shall soon see a notable stimulus to industry. Moreover, the money that might otherwise be wasted in

litigation will become productive in the hands of our energetic engineers.

One paragraph in Mr. Foote's letter is particularly pleasing. Here is an engineer, in charge of one of the most notable mines in America, almost a veteran in years and more than a veteran in experience, who has hit upon a new idea and put it into mechanical shape. He is told—by our genial friend from Salt Lake—that his patent has been anticipated, but that the scheme will work. Is he chagrined? No. He says: "As we cared nothing about the patent, it was enough for us to have the assurance that the machine would work." That is it, let us have machines that will work and fuss less about the patents; let metallurgical specialists make money not by collecting—or threatening to collect—royalties on inventions, but by manufacturing special machinery and showing others how to use such machinery successfully. Not that we deny the right to a royalty on a basic patent. Once more we see demonstrated that in the evolution of scientific ideas and in the invention of the devices that embody them, there is a wireless telegraphy which conveys messages to those least intended to receive them and that one of the best tests of the value of a new idea is the fact that it occurs to the mind of more than one man at one time.

Two Copper Mines.

USUALLY we avoid discussing the market value of mining stocks, for accurate information is difficult to obtain and the subject is traversed by treacherous undercurrents. But on another page we give an analysis of the data obtainable concerning the production of the Anaconda and the Calumet & Hecla mines. The contributor to whom we owe this analysis is one well informed in such matters and without any financial interest in either of these two enterprises. As for ourselves, this is a fitting opportunity for stating that the editor of this journal has no dealings whatever in mining shares, directly or indirectly, believing that such aloofness from speculation is essential to unbiased judgment.

As to the Anaconda, the figures show that the mine has returned to the shareholders an annual dividend of $2.39 per share of $25 par value, that is, 9.52 per cent per annum. The average yearly profit per pound of fine copper has been 2.83 cents. There is some surplus of cash and supplies, the total liquid value of which is not known to the public. Each share is annually represented by an output of 84.4 pounds of copper. The value of the ore produced has fallen in ten years from $15.93 to $10.54 per ton, while costs have diminished much less, namely, from $9.30 to $8.01 per ton, the margin of profit being $6.63 in 1896 and $2.53 in 1906. It may be interesting to our readers to know that the cost of mining, transport of ore to smelter, and reduction there, with refining and marketing of bullion—that is, the total operating cost was in 1905, 12.4 cents, less 2.4 for precious metals, making 10 cents; while in 1906 it was 13.3 cents, less 2.2 for precious metals, making 11.1 cents per pound of fine copper. On 14-cent copper the profit is not quite 3 cents and of this over 2 cents is in precious metals, so that the profit on the copper itself is less than 1 cent per pound. As to ore reserves, the amount of them is not known; as to these and other matters the shareholders are not informed. If the reserves are such as to warrant the continuance of the past average production for a further 20 years, then the present value of the stock, giving an income of $2.39 per share, would, if capitalized at 5 per cent, be $29.30 as against the present quotation of $33. It is not likely that any investor would care to do business on such a basis, in a mine subject to the usual risks and in one that has already shown a diminishing ratio of profit. Of course, people that buy Anaconda shares are not investors, scarcely speculators, more properly gamblers, for the information given is too scant for guidance and like the Amalgamated, this stock is a blind pool of the kind dearly loved by manipulators. As a matter of fact, we believe that more money is made out of the ups and downs of Amalgamated and Anaconda stocks than in any exploitation of copper ore in the mines at Butte. The financial coterie controlling them can afford to keep these stocks far above their real value, even in times of panic, because of the use of the shares as counters in a game thoroughly under their control.

Turning to the Calumet & Hecla, the prospect is more pleasing. We note that the average annual dividend during the last ten years has been $52.50 per share, the average annual production per share has been 855 pounds of copper, and the average profit has been 6.1 cents per pound of fine copper. The present yield of $52.50 per annum, if capitalized at 5 per cent for 20 years, is $654. The market price of the stock just now is $665. Moreover, as the data quoted by our contributor show, the Calumet & Hecla company is building up a handsome reserve, both of money and of new mining property. The Calumet & Hecla mines are bottomed, that is, the conglomerate lode passes at the bottom into the Tamarack ground, so that further possibilities in depth are barred, but by exploratory work on the Osceola amygdaloid lode and by purchases of the control in the Allouez and Centennial mines, the future capacity for production is ensured. The affairs of the Calumet & Hecla are wanting in the publicity that is reasonably to be expected of all corporations that exist under the laws of the State and in virtue of the protection given by those laws; and this obligation exists despite the fact that speculation in Calumet & Hecla shares is confined mainly to the five or six hundred shares that are on the market, the large holdings being entirely non-speculative. While Messrs. Agassiz, Shaw, and Livermore have exhibited a secretiveness, as to technical matters, that bespeaks an unprogressive and rather selfish spirit, yet we are glad now, as in the past, to emphasize the honorable character of their business management and the fact that they do state the main facts to their shareholders, and we believe that the Calumet & Hecla is deservedly to be regarded as one of the best conducted mining enterprises in existence at this time.

Personal.

HENRY W. TURNER is here.

WALTER HOVEY HILL is at Seward, Alaska.

ARCHIBALD A. C. DICKSON is on his way from London to India.

GEORGE KISLINGBURY has returned to Los Angeles from Pioche, Nevada.

S. H. BRADY is superintendent of the Belmont mine at Tonopah, Nevada.

EDWIN H. DAVISON has left for Mexico in the interest of an Oakland syndicate.

GEORGE C. CARSON, of Vancouver, Wash., has gone to Shasta county, California.

F. M. KIRSCH, of the Pacific Tank Co., has returned to Los Angeles from Arizona.

W. T. HOLBERTON has been appointed manager of the Llallague tin mines in Bolivia.

W. A. CARLYLE has been appointed consulting engineer to the Le Roi Mining Company.

THOS. HUGHES, Jr., is superintendent of the Chesterfield mines, near Tucson, Arizona.

JOSEPH MCGILLIVRAY is preparing to operate a large hydraulic mine in Trinity county.

H. G. HEFFRON has been appointed manager of the Gold Road mine, at Gold Road, Arizona.

FRANK HOLMES is manager for the Palmarejo & Mexican Goldfields Co., at Chinipas, Mexico.

W. A. WILLIAMS is here, on his return from a two years engagement in Chihuahua, Mexico.

CHARLES BUTTERS sailed on the *City of Panama* on January 25, on his way to Copala, Mexico.

H. P. ROBERTSON is now manager for the Gwalia Consolidated Company, in Western Australia.

L. D. MILLS, of the Homestake Mining Co., is in San Francisco, on his way to Goldfield, Nevada.

ROBERT HAWXHURST Jr. is examining the Miño silver mines, in the province of Tarapaca, Chile.

W. W. ELMER, of Sumpter, Oregon, is manager for the Consolidated Mining Co., at Santa Barbara, Mexico.

S. SYKES, of Johannesburg, passed through San Francisco on his way from London to China and India.

EMILE R. ABADIE has moved his office from the Union Savings Bank Bdg., Oakland, to 422 Pacific Bdg., San Francisco.

EMILE R. ABADIE Jr. has returned to San Francisco from the mines of the United Mines Corporation in Tuolumne county, California.

F. M. LELAND resigned from the staff of the Risdon Iron Works recently to become manager of the Washington mine at French Gulch, California.

J. B. FLEMING has left the employment of the Joshua Hendy Iron Works to join the staff of the Goldfield Con. Mines Co. at Goldfield, Nevada, as mechanical engineer.

W. A. HEYWOOD has returned to London from Siberia. He goes shortly to South Africa to investigate the metallurgy of the Namaqua Copper ores.

GORDON F. JANNEY, who is operating a dredge on Clear Creek, in Shasta county, was here this week.

W. H. WEED is at Chilpancingo, Mexico.

GEORGE O. BRADLEY, chief engineer to the Utah Copper Co., has been tendered the position of general manager for the Pittsburg Silver Peak Mining Co., operating at Blair, Nevada.

ARTHUR L. WALKER has severed his connection as advisory metallurgist to the American Smelting & Refining Co.; he has opened an office as consulting engineer at 71 Broadway. On January 25 he left for Bermuda on a short holiday.

Latest Market Reports.

LOCAL METAL PRICES—Jan. 30.

Antimony	12@16c	Quicksilver (flask)	$45@45.50
Casting Copper	17⅛@18¼c	Spelter	6½@ 7¼c
Pig Lead	4.10@ 5.05c	Tin	33@34⅛c

ANGLO-AMERICAN SHARES.

Cabled from London.

	Jan. 23. £. s. d.	Jan. 30. £. s. d.
Camp Bird	0 14 9	0 16 3
El Oro	1 1 3 ex div.	1 0 7½
Esperanza	1 8 9	1 5 0 ex div.
Dolores	1 7 6	1 8 9
Oroville Dredging	0 12 3 ex div.	0 12 3
Stratton's Independence	0 4 0	0 3 9
Tomboy	1 7 6	1 8 9

(By courtesy of W. P. Bonbright & Co., 24 Broad St., New York.)

MINING STOCK QUOTATIONS—NEW YORK.

	Closing Prices. Jan. 17.	Jan. 30.
Alaska Mexican	.....	⅛
Alaska Treadwell	.....	25¼
Bingham Central	⅝	¾
Boston Copper	14⅞	15½
Cumberland Ely	.....	7⅞
El Rayo	1¾	1⅝
Guanajuato Con	2¼	2⅛
Giroux Con	4	⅞
Nevada Con	11¾	11
Nipissing	7	6⅞
Tennessee Copper	29	30½
United Alaska	.....	.....
United Copper	6¼	6
Utah Copper	25¼	27

(By courtesy of Hayden, Stone & Co., 25 Broad St., New York.)

SOUTHERN NEVADA STOCKS.

San Francisco, Jan. 30.

Atlanta	$ 40	Laguna	1.00
Belmont	1.05	Manhattan Con	21
Columbia Mtn	23	Midway	80
Combination Fraction	90	Mizpah Extension	10
Daisy	1.15	Mohawk	15.00
Fairview Eagle	58	Montana Tonopah	1.80
Florence	4.80	Nevada Hills	3.25
Gold Bar (Bullfrog)	40	Red Top	.....
Goldfield Con	5.60	Sandstorm	37
Goldfield of Nevada	.....	Silver Pick	36
Gold Kewanas	53	St. Ives	51
Great Bend	25	Tonopah Extension	1.20
Jim Butler	38	Tonopah of Nevada	5.05
Jumbo	.....	Tramp Con	18
Jumbo Extension	56	West End	30

(By courtesy of W. C. Ralston, 353 Bush St.)

COPPER SHARES — BOSTON.

	Closing prices. Jan. 30.		Closing prices. Jan. 30.
Adventure	2	Michigan	11⅛
Ahmeek	60	Mohawk	55
Allouez	30¼	Nevada Con	10⅞
Amalgamated	51¼	North Butte	49½
Arcadian	4½	Old Dominion	37½
Atlantic	12¼	Osceola	86
Balaklala	2⅝	Parrot	13½
Bingham Con	4¾	Phœnix	1
Boston Con	.....	Quincy	90
Butte Coalition	19¼	Raven	1⅜
Calumet & Arizona	112	Rhode Island	4⅛
Calumet & Hecla	660	Santa Fe	2¼
Centennial	24½	Shannon	12½
Con. Mercur	.....	Superior & Pittsburg	14
Copper Range	64¾	Tamarack	65
Daly-West	8¼	Trinity	15½
Franklin	9	United Copper com	6
Granby	.....	Utah Copper	26¾
Greene-Cananea, ctf	8¾	Victoria	5
Isle Royale	24½	Winona	5⅛
Mass	3½	Wolverine	125

Structural Material.

Base prices f. o. b. cars San Francisco.

Brick, common, per M	$8.50
Cement, domestic, per bbl	$1.90
Cement, foreign, per bbl	$2.75@3.25
Firebrick, domestic, carload lots, per M	$37.50
Firebrick, English " "	$50@55
Lime, per bbl	$1.15@1.25
Lumber, Ord. Dimension Stock, f. o. b. Gray's Harbor, per M	$10.00
Mining timbers, f. o. b. Gray's Harbor, per M	$9.00
Nails, per keg	$3.20

General Mining News.

ALASKA.

(Special Correspondence).—Since the close of navigation several new and important placer discoveries have occurred on Seward Peninsula. Two of these are known as 'submarine beach pay-streaks,' (found in frozen ground below present sea-level) and have already developed into rich, paying properties. All are being tapped at about the same level by a continuous line of shafts on the divide between Penny and Snake rivers, west of Nome, and three-quarters of a mile south of the foothills. Kennedy, Brown & Bruner Bros. have located the pay-line at a depth of 112 ft. The submarine beach found by Seiffert, Gibson, Elliott and others, west of Nome is being followed in a continuous line to Penny river; heavy pay-dumps are manifest along the route. In places good pay-ore of great extent and value has been blocked out.——Halla & Webb are the fortunate discoverers of another rich beach-line that equals if not surpasses the famous 'third beach.' It was recently located about 360 ft. south of the former line, which ran through the Portland Beach, Bessie, and Cyrus Noble claims; it runs east and west, apparently paralleling its older rival.——A strange thing happened on Nov. 25. Volcanic ashes fell to such an extent over all parts of Seward Peninsula, from Kotsebue sound to Norton bay, that it covered the snow in many places like a great dark-brown blanket. The ashes were so gritty as to impede travel by sleigh and dog-teams everywhere. Natives from the Kobuk region arrived in Candle City yesterday and reported the disappearance of a prominent mountain near Cape Blossom, which sank amid "much noise, steam, and smoke" on Nov. 22. Thousands of tons of sandy ashes fell in Nome and vicinity, fully 250 miles south from the reported disturbance. A local chemist has promised an analysis of the strange substance, which, though very fine, greatly resembles the ruby sands found along the beaches of Bering sea.——The labor situation at Nome is growing acute and, although the Western Federation of Miners has practically won its closed shop regulation, a rigid adherence to this rule may prove very difficult. The latest move of this organization has been productive of great friction between the labor unions of this section. The cause of this difficulty is the persistent refusal of the Western Federation of Miners to recognize the cards of any of its local sister unions that are affiliated with the American Federation of Labor, except the Industrial Workers. An allied Trades Assembly has been formed in Nome to combat these conditions, and an attempt will be made to stop the Industrial Workers from 'scabbing' on members of the other unions. The latest addition of a number of Japanese, Russians, and Italians, into the ranks of the Industrial Workers has caused much comment and excitement among the laboring element, of which Nome has already an oversupply.——The Government has erected a Federal jail on the city square and a new edifice for the District Court, is in course of construction. Twelve acres of ground in the city of Nome have been requested from the trustees for the erection by the Government Telegraph Co. of a permanent wireless station, which will connect Nome direct with the States next summer.——The action of the Juneau Republican convention in repudiating Governor Hoggatt and Banker Whitehead, is generally acceptable to the people of Nome, who are nearly a unit for Cale and territorial government.

The pay-streak on the Lakeview claim, on the third beach-line, is without question the richest ever found in Alaska. Pans from $60 to $100 have been found and there is an extensive body of pay-gravel which readily yields $1 per pan without picking. The rich strike was made recently by Niebuhr & Bounds who are working the ground on a lease.

Nome, Dec. 7.

The indications are that 20,000 miners and prospectors will go to Alaskan camps during this year. The steamship *Saratoga* left Seattle, Wash., on Jan. 25 with 200 miners for Valdez and Cordova. The Tanana Mine Owners' Association is sending north 150 miners. Beginning in May, 8000 to 10,000 men, it is expected, will go to Nome and other Seward Peninsula camps. Prosperity and high wages obtain in every mining camp in Alaska.

ARIZONA.

COCHISE COUNTY.

The Supreme Court of Arizona has decided to compel J. N. Gaines, the tax collector of Cochise county, to collect in full the taxes assessed against the Copper Queen Co. for 1905; Gaines and the board of supervisors had compromised with the company for a considerably less sum than the amount due.——Rex McEwan has brought suit against the Denn-Arizona Mining Co. for $15,000 and costs of suit; he alleged that he has been crippled for life by injuries received from an accident in the shaft when the cage dropped onto the chairs at the 1100-ft. station with great velocity.—The Empire Copper & Gold Mining Co. has resumed sinking its two-compartment shaft at its mine near Johnson.

GILA COUNTY.

The Old Dominion company was forced recently to close one of its four furnaces on account of shortage in the supply of sulphide ore, but this will only be temporary, as sulphide ore from various outside camps has been contracted for and is now on the way to Globe. Work is being rapidly pushed on the 16th level of the Old Dominion mine; from this level the management hopes in time to extract sufficient sulphide ore to make shipment from the outside unnecessary.——Considerable excitement was caused in Globe by the reported gold strikes in Lost gulch and in the Pinal foothills 7 miles southwest of the city; rich samples were displayed in the city.——The National Mining & Exploration Co. has bought the Fumarole mine in the Gila mountains near Safford; a steam hoisting plant has been ordered for the property and a shaft will be sunk to a depth of 2000 ft.——The orebody exposed on the 450-ft. level of the Iron Cap mine is 30 in. wide; it carries 20% copper.——At the Gem shaft of the Globe Consolidated mine a crosscut is being driven on the 12th level.——At the Gibson mine 50 men are at work and shipments of ore are being made daily to the Old Dominion smelter.——T. E. Farish is developing the Independence mine; he is making shipments of high-grade sulphide ore.——It is said that a sample of the dump of a winze at the Black Hawk mine yielded at the rate of 10% copper, 4 oz. silver, and 0.02 oz. gold per ton.——It is reported that Charles E. Finney has secured $1,200,000 in Boston with which to build a 600-ton smelter on the property of the London-Arizona company near Winkelman on the Phoenix & Eastern railroad.

GRAHAM COUNTY.

It is announced that the directors of the Arizona Copper Co. have appropriated $100,000 for improvements in the smelter at Clifton; John W. Addies has been appointed consulting engineer and will have charge of the work on the improvements.

MARICOPA COUNTY.

It is reported that the Grand Traverse & Arizona Mining Co. has found a body of good ore at its mine in the Cave Creek district; C. F. Smurthwaite is general manager.——The Copper Top Co. has contractors at work on some of its claims.——Machinery is now enroute from Denver for the working of 2000 acres of placer ground near Wickenburg. The ground has been prospected by Barth & Holden, who claim that the gravel carries about $1 per ton.

PINAL COUNTY.

The new Imperial smelter, south of Red Rock, has been completed and blown in.——The Copper Butte Mining Co., it is expected, will resume work at once on its properties.——John McCabe is planning to build a 15-mile aerial tramway from the Silver King mine to Price station, where a 50-ton smelter is to be erected.

YAVAPAI COUNTY.

Th directors of the Jesse Mines Co. have decided to erect a 50-ton reduction plant; it will comprise stamps, concentrators, and a cyanide plant. The Jesse mine has a record in gold production of over $750,000; it is opened by a shaft 657 ft. deep, and it is said to have a large tonnage of ore ready to be stoped and treated as soon as the new mill is ready for operation.——Three tons of ore from the bottom of the 200-ft. shaft of the Square Deal mine in the Cherry Creek district were milled for a test; they yielded a bar weighing 5.34 oz. The shaft is on the hanging-wall of a large porphyry dike that contains several veins of gold ore.——The Majestic Mining Co. is unwatering the Lion shaft. It is also driving adits on other claims of the group; good ore is being mined from two of these adits.——The Climax Mining Co. recently made a test mill run of its ore; it is said the mine has a large tonnage of ore in reserve, and needs a larger milling plant.——Morgan Tillinghast of Philadelphia has made the final payment on the Monica group of mines; he has had this property under development for two years. The vein is cut at a depth of 1100 ft. by an adit 1300 ft. long. The vein is opened a distance of 1500 ft., the orebody being continuous the entire distance. The property also has a mill.——Ore averaging $100 gold per ton is being mined from an adit of the Wren mine in the Hassayampa district. High-grade ore has been found at a depth of 40 ft. in the Jayhawker mine, which is owned by the company that owns the Wren mine; R. A. Sweet is general manager.——It is reported a very promising gold strike has been made on an extension of the Rockefeller mine on the divide between Big Bug and Lynx creeks.—— At the United Verde smelter three furnaces are at work; the installation of new machinery with which to work the large new furnace is rapidly proceeding.

YUMA COUNTY.

A. W. Womble has been investigating the Amavista strike; he is reported to have said that it looks better with every additional foot of development.——E. Holden and T. J. Carrigan will put a force of men at work developing the Northern Light mine near Bill Williams Fork river.

CALIFORNIA.

AMADOR COUNTY.

Charles E. Hussner, who has been experimenting with the tailing from the Argonaut mill has arranged to install a plant and work this tailing; he hopes to catch the floating gold and amalgam that are now escaping from the mill.

CALAVERAS COUNTY.

The Melones mine was closed on Jan. 11 by a strike of the 175 employees, who demand a 9-hr. workday. The management is determined to make no concessions and it is generally expected that the struggle will be a bitter one. ——At the Boston mine an 1800-ft. three-quarter-inch steel cable has been put in; unwatering the mine is proceeding rapidly.——The work of repairing the Cross shaft of the Utica mine, which was damaged by a recent explosion, is advancing satisfactorily; the management expects to have the mine in operation in a few days.——Charles Hogan was assaulted and cruelly beaten by a gang of non-citizen miners at his home in Melones on the night of Jan. 19. His offense to them was that he would not unite with the strikers at the Melones mine. A citizens' protective association has been organized in Melones; this has let it be known that it has ropes and that trees are handy.

EL DORADO COUNTY.

Fred Schmeder has begun working his Barney mine.—— P. C. Drescher has purchased the Montauk Consolidated mine, in the northern part of the county; he intends to restore the mill and resume work in the mine.——Louis Koerber is working on his claim north of the Taylor mine. ——Preliminary work is to be begun at the Collins-Bacchi mine near Garden Valley for the sinking of a shaft 500-ft. deep; buildings will be erected and machinery hauled to the mine as soon as the roads are in good condition.

INYO COUNTY.

P. Calderwood and H. Scott have 12 men driving a 500-ft. adit at the Ubehebe mine; this adit will cut the vein 760 ft. below the outcrop.——At the Black Canyon mine an orebody has been cut by a drift 25 ft. long; it carries more gold than any other in the mine.——Al Stevens has a small force of men at work on his lease at the Brownie mine at Buena Vista.——Stocking & Denison are employing 15 men. ——The 3-stamp mill at the foot of Queen canyon is running on ore from a lease in the Buena Vista district; this ore carries $30 to $40 per ton.——The Bishop Creek Gold Co. spent in 1907, $91,107.33 in labor, machinery, and material.

KERN COUNTY.

B. Ostick and associates have secured $1200 in a three weeks' run of the Kinyon 2-stamp mill on ore from the G B mine.—Peter McMahon has taken a new lease on the Butte mine and has some men at work.

NEVADA COUNTY.

(Special Correspondence).—Good ore was recently struck in a winze in the Brunswick mine. Developments are going on at several points and a large force of men are employed; the mill is running on a fair grade of ore.——Sinking continues at the Central shaft; rapid work has been retarded by falling rock, but good progress is now being made and the shaft is considerably below the 5000-ft. point.——A full force of men is working at the Empire mine and a large tonnage of excellent quartz is being handled. Exploration and development work is going on in the lower levels. A large reserve of milling ore has been developed apart from the main lode.——Several men are working at the Conlan mine in accordance with a private agreement with the company. It is understood that they are working on a royalty basis. It is reported that good ore is being extracted.——The ore-shoot recently encountered at a depth of 800 ft. in the Idaho-Maryland is continuing to show well. Several men are employed and good ore has been extracted. The Sultana M. Co. is working a large force of men at its properties. Most of this work is being carried on through the Presscott Hill shaft. Good ore has been opened up at several points. C. K. Brockington is superintendent.—— The C. C. Mitchell ranch, lying near the Idaho-Maryland and Brunswick mines, has been acquired by the Lily G. M. Co., a Nevada City corporation, and will be extensively worked. There are three north and south lodes and an east and west vein. A shaft will be sunk and other work carried on. The ore assays from $1.60 to $20 per ton. The veins are from a few inches to 3 ft. wide.——About 40 men are working at the Pennsylvania mine; considerable exploration work is being carried on.——W. P. Martin and associates are developing a small body of good ore in the Golden Gate mine. The shaft is being sunk to enable the deposits to be worked at depth.——The Champion Mining Co. has a large force of men at work; a large tonnage of ore is being treated. Most of the high-grade ore is coming from the vicinity of the Home shaft, while a large quantity of lower grade has been developed in the old Champion workings.——The 10-stamp mill at the Ancho mine is running on good milling ore. The vein in the lower adit is showing improvement in size with depth. The working force has been increased.——Good results are being obtained from the working of several placers in the Washington district. Several men are employed and the season promises to be a very successful one.——The copper slump has forced the suspension of work on the copper prospects in the French Corral and Spenceville districts. It is reported that work will be resumed as soon as the market re-adjusts itself.——Robert Johnson reports that the antimony lode recently struck on his ranch, a few miles below Grass Valley, is showing up well with limited development. The lode is being prospected by Johnson and sons, who believe that they have the makings of a valuable property.——The present winter has been moderate and the mines have not been forced to use the large pumps which were installed last fall in anticipation of a

severe season. While the rain-fall is considerably less than that of last season, there has been heavy snow-falls in the adjacent mountains. This assures an adequate supply of water for the coming year.

Grass Valley, Jan. 27.

PLACER COUNTY.

R. L. Fletcher has four men at work at the Paragon mine; Tom Brown is in charge.——At the Three Star mine, stoping continues on the 1200-ft. level.——The adit at the Hidden Treasure mine is still being driven along the blue lead toward the old Mountain Gate mine.——The lessees of the Big Dipper mine are taking good gravel from new ground.——The Peckham Hill property has again been bonded.——The Bellevue company has decided to prosecute work on the 400-ft. level of its mine.——The Home Ticket mine at Last Chance is yielding good gravel; the manager is still following the Pennsylvania system of blocking out the gravel.

PLUMAS COUNTY.

A new company has recently overhauled the mill at the Plumas-Eureka mine and has built a tramway from the upper workings of the mine to the mill. The company has 25 or 30 men working, mostly stoping and driving.——The Little Jamison mill is temporarily closed down on account of shortage of water; 50 to 60 men are employed in the mine. S. W. Cheyney is superintendent.

SHASTA COUNTY.

The Summit group of 30 copper mining claims near the Mammoth mine has been sold by the Phoenix Securities Co. to the Stauffer Chemical Co. for cash.——Ore is now being taken from the Mammoth mine to a smelter over the new rail-track haulage system; the capacity of this system is much greater than that of the old aerial tram system.——The track of the Sacramento Valley & Eastern railway has reached Copper City. This will permit the shipment to Delamar of the great heaps of coke that lie at Pit station.——The oil storage tank for the Delamar smelter has been completed; the steel furnace stack is nearly finished.

SIERRA COUNTY.

While sinking a winze in the long adit of the Telegraph mine in search of a lost quartz vein, very rich gravel has been found. It is 3 ft. thick and is supposed to be a continuation of a gravel channel which was worked several years ago.——Piping has begun at the McNulty placer mine at Balsam flat; W. W. Tiner is superintendent.——A full force of men is at work again in the Young America gravel mine near Forest.——The Omega Gold Mining Co. has purchased a 3-stamp mill to treat the cemented gravel in its mine near Forest; Chas. H. Brown is superintendent.——It is reported that at the Ruby mine the vein has been cut in the adit and the company is now driving on it to get quartz for a mill-test.——At Sierra City a good deal of development work is being done in mines other than the Sierra Buttes; at the Cleveland mill eight stamps are dropping.——At Poker flat the Freeboroughs have finished a run of ore through their Huntington mill; the result is said to have been satisfactory.

SISKIYOU COUNTY.

Con Sullivan and William Ackers have found a gold-bearing porphyry dike in the Scott Mountain region, 9 miles south of Callahan; it is 20 ft. wide and ore taken from a 6-ft. shaft sunk in it carried $12 per ton.——Fifteen teams are hauling timber from the Manly saw-mill to the new dredge being built near Callahan by the Brownell & Mayhew Co.——S. R. Gardner and Abner Weed have merged their mining interests in the Quartz Valley district and they are expected to make a successful run this season.

TRINITY COUNTY.

Surveys for ditches and flumes have been commenced at the Quimby mine in the New River district. J. A. Brent is manager.——The Abram-Karsky Co. has won its suit against the Bullychoop Mining Co. to recover about $7000 claimed to be due the mercantile company for goods furnished to the Bullychoop company.

TUOLUMNE COUNTY.

It is reported that eastern parties have deposited a sufficient sum of money to practically assure that they will buy the Dutch Mining Co.'s property for a sum ample to pay every creditor 100 cents on the dollar.——The machinery for the United Mines mill is on the ground ready to be erected; the Lady Washington adit is being cleaned out.——Good ore from the New Albany mine is being crushed in the old Grizzly 20-stamp mill.

YUBA COUNTY.

Machines are to be installed at the Blue Point mine to work the dumps for the platinum that they contain. G. L. Holmes of San Francisco is selecting the site for the plant.

COLORADO.

CLEAR CREEK COUNTY.

(Special Correspondence.)—A rich strike has just been made at the Columbia mine, situated on Silver mountain. The streak measures from 18 in. to 2 ft. wide, and carries $39 per ton in gold. Driving is in progress and as soon as the ground has been opened for 50 ft. stoping will be started. J. Graham, of Empire, is operating the property under lease.

Map of Northern California.

—Report is current that the Doric adit holdings will shortly be consolidated with those of the Capital M. & T. Co. The Doric adit is in Saxon mountain 3008 ft., and by running a lateral to the west the heading would cut the veins controlled by the Capital company at a depth of from 500 to 700 ft. under the present workings. The Capital company is being financed by four millionaires of Pittsburg, Pa., with Wm. M. Cooper of Georgetown serving as general manager.——The Hoery group of claims on Griffith mountain is being developed in an energetic manner. The adit is being driven steadily forward, and a cross vein will be reached within the next few feet. Considerable scattered mineral is showing in the heading, which carries much silver and lead.——Shipments have been inaugurated from the Gambetta vein, intersected through the Joplin adit. Stoping is in progress upon a streak of ore measuring from 12 to 15 in. wide; average returns of 70% lead and 48 oz. silver per ton are being realized. B. J. O'Connell of Georgetown is resident manager.——The adit being advanced to intersect the 700-ft. level of the shaft workings of the Shively mine is nearing the objective. There yet remains 75 ft. of ground to be broken, but headway is being made at the rate of from 3 to 4 ft. per day. With this work completed the old workings of the mine will be drained of their great bodies of water, while at the same time a good circulation of air will be obtained. B. J. Martelon of Silver Plume is superintendent.——The

Silver Leaf adit on Brown mountain is being advanced at the rate of 3 ft. per day, a Temple electric drill having been brought into use. Two veins have been passed, but no driving carried forward on them.——Work will be resumed in a few days upon the Charter-Raton group of claims, situated on Breckenridge mountain. The La Moe adit is to be continued on into the hill and according to surveys the Charter vein will be reached within 150 ft. A compressor plant was installed a few months since. J. J. Bonner of Georgetown is resident manager.——Chas. Carlson, leasing on the Lucky Hesperus mine, on Democrat mountain, has encountered a streak of 700 oz. silver ore and shipments will soon be started. The discovery was made in running a cross-cut to get under the old workings, whence some of the richest ore ever mined in the Georgetown district was taken a few years ago.——A carload shipment of smelting ore was made last week from the Sidney adit workings. The product was delivered at the Santiago sampler and settlement was made at the rate of 88 oz. silver per ton and 44% lead. Stoping is under way upon a streak of ore measuring from 4 in. to 2 ft. wide.——Chas. Jones, leasing on the Bellevue-Hudson mine, on Columbian mountain, has found a 14-in. vein of 147-oz. silver ore. The discovery was made in sinking a winze from the sixth or main level. Considerable water has been encountered and it will be necessary to install a pump at an early date. ——A night shift has been put on at the American Sisters 50-ton mill. The mill is to be fed upon the higher grade ore, as it has been decided to discontinue the treatment of the lead and zinc until the price of those two metals has advanced. The last shipment of concentrate after being run in two classes brought returns of 300 and 97 oz. silver per ton and 25% lead. Over 300 tons of smelting ore awaits shipment; it will mill better than 300 oz. silver per ton. J. J. White of Georgetown is general manager.

Georgetown, Jan. 27.

IDAHO.

BLAINE COUNTY.

Sinking has been suspended in the shaft of the Idaho Consolidated Mines Co. until the completion of the electric power plant. Work on the mill is being hurried, with the intention of completing the plant before the middle of April. Aldred & Smith, the contractors for the Idaho Consolidated dam, are importing teams and men from Utah.

IDAHO COUNTY.

A good body of free-milling gold ore has been found at the Star mine.——It is reported that the owners of the Butte-Orogrande mine intend to resume operations in the spring. The cyanide plant is to be replaced by a mill using a new process for reduction of ore.——A five-stamp mill will be erected at the South Fork mine as soon as the weather will permit.

LEMHI COUNTY.

(Special Correspondence).—The Lemhi Smelting Co. has been organized by D. E. Coughanour, H. L. Fisher, A. E. Carlson, H. E. Neal, and C. M. Stolle, of Boise, to erect a one-furnace lead smelter at a place between Spring mountain and the Gilmore mine, 70 miles west of Dubois station on the Oregon Short Line. It is stated that the ore supply will come from the Iron Mask, High Ore, Russell, Bruce, Forrester, Lemhi, Gilmore, and other mines. The ores of the locality comprise lead carbonate and galena, accompanied by silver and gold.

Salmon City, Jan. 25.

OWYHEE COUNTY.

Ore has been found in the upraise at the Village Blacksmith mine; several tons of it in a bin at the mouth of the adit contain $100 per ton.——At the Potosi mine a station is being cut preparatory to driving on the lowest level where the vein has recently been found in a cross-cut.——The Banner mill building has been completed and a transformer building is being erected. Two batteries, a 35-h.p. motor, pans and settlers have arrived at the property. A body of high-grade ore has been cut in the mine.

SHOSHONE COUNTY.

It is announced that the Panhandle smelter will resume operations about Feb. 1; it is to handle 6000 tons of ore per month. The Pennsylvania Smelting Co. will have a one-third interest, several of the producing mines in the Coeur d'Alene will have one-third and J. H. Anderson and associates the remaining interest in the ownership of the smelter.

NEVADA.

ELKO COUNTY.

Much development work is being done at Gold Circle.——W. D. McClelland and John Slaven have found at their Water Witch claim an orebody 18 in. wide; the ore is said to carry $75 per ton.——B. S. Tracey and associates are working the Elko Prince group of claims; they have found a lode 4 ft. wide containing ore carrying $5 to $114 per ton.——Some good gold ore has been found at Frazer creek and between Frazer creek and Scraper spring, five miles northeast of Summit townsite.——Two shafts on the property of Henderson & Pixley, 20 miles north of Carlin, develop an orebody 18 in. wide, that is said to carry 407 oz. silver and $2 gold per ton, besides a high percentage of lead.

ESMERALDA COUNTY.

The Nevada Legislature's police bill, which provides for a superintendent, inspector, sergeants, 25 subordinate officers, and 250 privates, was passed by the Senate on Jan. 24. It was then held up by a committee of the Assembly, pending a decision by the Goldfield Mine Operators' Association to abolish the card system, which required all employees to sign an agreement renouncing the Western Federation of Miners. On Jan. 27 the open-shop policy was adopted at the Goldfield mines; on the same date the Assembly passed the police bill. A bill was introduced in the Senate on Jan. 28 which will make it possible for the Attorney-General to remove the District Attorney at Goldfield, who, it is alleged, may have failed to perform the duties of his office.——The Combination mill is treating 90 tons of ore per day and there is a sufficient force of men at work in the Combination mine to keep the mill supplied with ore and further the development of the orebodies.——At the Mohawk mine men are opening up the orebodies on the lower levels and sinking the main shaft; no ore is being broken for the market.——Grading for the big new mill of the Goldfield Consolidated Mines Co. is progressing; 35 men are working at it.——The Gotwaldt lease on Combination No. 1 claim is expected to be the next shipper from Goldfield Consolidated ground; at a depth of 94 ft. the vertical working shaft has cut what is presumed to be the old Reilly lode. An electric hoisting plant is being added to the lease's equipment.——The Goldfield Mine Owners' Association announced on Jan. 24 that it could find places for 1000 miners at once. Local miners will be given the preference, but if the requisite number is not obtainable, men will be brought in from Utah.——More rich strikes are reported from the Rawhide district. On the Grutt lease there has been uncovered a body of ore that may be very large. One piece a foot long and 6 in. wide fairly bristled with gold.——Frank Boehme and others have bought the Murray lease and the Drew group of claims north of Grutt hill.——The Stinson lease on the Tiger group of claims has been sold to Colorado and New York capitalists.——On the Vickers property at Stimler, 28 leases are being worked; 18 of them are in ore. The shaft at the Irwin-Watson lease is 83 ft. deep; 40 to 50 sacks of ore carrying $150 per ton are being shipped daily. ——A hoisting plant is being taken from Goldfield to Rawhide to be installed on the Balloon lease.

HUMBOLDT COUNTY.

Copper stains are appearing in the ore of the Seven Troughs mine; this is considered a good indication; 35 men are employed.——The Glasgow & Western Exploration Co. is working a large force of men at its mine and mill near Golconda.——Active work has been resumed at the Signal Peak mine near Vernon.

LINCOLN COUNTY.

The Mizpah Mining Co. has installed a 6-h.p. hoist and will resume sinking its shaft to the 200-ft. level.——On Jan. 15 water was struck in the new vertical shaft of the Blossom mine at a depth of 280 ft.; good ore extends across the bottom of the shaft.——At the Chiquita mine, 20 miles south of Searchlight, the mill is crushing high-grade ore.——W. R. Groff and E. S. Beeson, it is reported, have made a strike of very rich gold ore on the Esther group of claims.——The Nevada-Utah Corporation has added 30 men to its force at the Day mine; J. P. Gaskill is general manager.

NYE COUNTY.

The ore shipments over the Tonopah & Goldfield railroad for the week ending Jan. 23, as reported by the Western Ore Purchasing Co., consisted of 80 tons from the Tonopah Extension mine. The Tonopah company sent 3130 tons, the Belmont company 880 tons and the Montana Tonopah 1100 tons to the mills, making the total shipments for the week 5190. The total output of the Tonopah mines was 5190 tons, of an estimated value (the shipping ore being valued at $50 per ton and the milling ore at $20 per ton), of $106,000.——At the Montana Tonopah mine a large body of ore has been uncovered at the 600-ft. level; it is 5 ft. wide and much of it carries $35 per ton. The 40-stamp mill is running steadily, with satisfactory results.——The West End Consolidated Co. is prosecuting systematic work on the apex of the big vein to enable it to prove its connection with the MacNamara vein in the suit which will come up for trial in the district court next April.——The North Star company is driving westerly on the fault-plane encountered at the 1250-ft. level; ore is being stoped at the 900-ft. level.——At the Midway mine the winze which is being sunk from the 800-ft. level on the big vein that was encountered about 800 ft. north of the shaft is now down 90 ft. Arrangements have been made for the erection of a mill at the Golden Sceptre mine at Rhyolite.——The cyanide plant at the Gardner mill at Goldfield is to be removed to the Bullfrog Pioneer mine.——The Gold Bullfrog mill is in full operation; H. W. Preston is manager.——Five carloads of machinery have arrived for the Homestake King 25-stamp mill.——Another carload of concentrate has been shipped from the Shoshone mill; the covering for the cyanide vats is nearly finished.——Excavation for the 50-ton Springdale mill has been commenced.——John Lindblom has men working on the claims of the Lulu Mae Mining Co. in the Funeral range.——At the Solid Gold lease at Round Mountain pockets of wire gold encountered every day are extracted by hand.——Placer ground has been found in the vicinity of Silver Point.——A rich strike at Baxter Springs consists of a stringer ½ in. to 14 in. wide probably carrying $150 to $200 gold per ton; it was made on the property of the Baxter Springs M. & M. Co.——The big mill at the Johnie Consolidated mine is finished; it has 16 Nisson batteries. The capacity is 150 tons per day.——R. W. Sparling has taken a contract to treat the dump of the National Bank mine at Rhyolite and has begun work on the plant he proposes to erect.——Ten men will be added to the working force at the Bullfrog West Extension mine.——At the Hayseed mine near Lee, the drift on the 100-ft. level is 380 ft. long; it exposes ore supposed to carry $60 to $100 gold per ton.

Montana-Tonopah Mill.

The Midway Mine.

near Northport is giving employment to two shifts of men, driving on the vein on the 200-ft. level for the pay-shoot which goes down from the 100-ft. level.——The North Star Mining Co. promises to start active work on its mine on First Thought hill near Orient as soon as snow disappears. J. E. Pierell and George Sisler of Spokane are directors of the company.——The Spokane Lead Mines Co. at Metaline has nearly completed the installation of machinery for the concentrator and expects to have the mill running in a week or two; the mill building is finished.

Republic, Jan. 22.

WASHINGTON.

STEVENS COUNTY.

(Special Correspondence).—In the United Copper mine, in Chewelah district, a streak of ore about 2 ft. wide has been developed on the footwall of the vein in a drift about 300 ft. from the end of the adit; it is highly impregnated with native silver, an unusual occurrence in the district. At the end of the south drift the vein is 6 to 8 ft. wide, the full width being copper-bearing ore of good payable quality.——It is reported that good ore has been found at the bottom of the shaft of the Kettle River mine, near Rockcut. Manager E. W. Scothorn is arranging with his company for more extensive operations.——A shoot of ore carrying gold, silver, and copper is under development in the Twilight mine, on Jumbo mountain. The vein is at a contact between granite and porphyry.——The Sunset mine

CANADA.

BRITISH COLUMBIA.

The ore shipments from the mines of the Rossland district for the week ending Jan. 18 were as follows: Centre Star, 3330 tons; Le Roi, 1588; Le Roi No. 2, 463; total, 5381 tons. The shipments from the Boundary district were 16,359 tons; from the Slocan-Kootenay district, 2911 tons. At the smelter at Trail there was received during the week 4867 tons of ore. Besides that sent from Rossland, shipments were received as follows: St. Eugene, 332 tons; Ruth, 113; North Star, 90; Vancouver, 81; La Plata, 69; Nugget, 64; Arlington of Erie, 52; Rambler-Cariboo, 44; Standard, 38; Ferguson, 30; Whitewater Deep, 23; Canadian Group, 22; Emerald, 21; Sunset, 21; Reco, 20; Keystone, 20; Sunshine, 20; Hewitt, 20 tons. The receipts of ore at the Le Roi smelter at Northport consisted of 1609 tons received from mines as follows: Le Roi, 1588 tons; First Thought, 21 tons.

Special Correspondence.

LONDON.

Gold Mining in Egypt.—Stratton's Independence.—Broken Hill Mines.—Record of Concentration.—Australian Smelting Corporation.

It is not altogether a surprise to hear that the recently created Department of Mines in Egypt is to be suppressed at an early date. The Egyptian Government and its English advisors have never been very friendly to the mining industry, and prospecting and development have never been free to any comer. Instead of letting the poor but practical prospector scratch the earth and roam about at will, they mapped out the country into sections and the right to prospect was sold to corporations or to individuals who could put up a good deal of money. Up to the present time most of the prospecting has been done by three influential groups, represented respectively by John Taylor & Sons, Lake & Currie, and C. J. Alford. Such gold mines as have been reopened, have proved lean and patchy, and have scarcely been successes. A few years ago a Department of Mines was established as a branch of the Ministry of Finance, and Mr. Wells and Mr. Greaves, who had previously been in the service of the Lake & Currie group, were appointed as chief and assistant. Money was liberally spent with the alleged object of popularizing Egypt as a country for mining operations. It was not a surprise, however, to hear that the Government, finding their schemes unsuccessful, had decided to drop the matter. At the present time the irrigation of the country absorbs the attention of the Government and its engineers, and great advances are being made in utilizing the waters of the Nile for the purpose of enriching the soil of the adjacent desert. With regard to the gold deposits, it seems to me probable that they were mined and exhausted thousands of years ago. History and tradition point to the riches of the country in by-gone ages, and the engineers who were capable of building the Pyramids may have known something of gold-milling and extraction.

The annual report of Stratton's Independence has been published this week. It gives the financial results of the operations during the year July 1, 1906, to June 30, 1907, and it contains a more recent report by Mr. Philip Argall relating to the prospects of the new plant for treating the low-grade and dump ores. During the twelve months, the operations were entirely done by lessees. They produced 38,880 tons of ore, of which 13,951 tons were shipped to the smelters and the remainder added to the dump. This ore realized £124,219, or, after deducting freight and treatment, £91,842. Of this sum £58,254 was paid to the lessees and £33,588 retained by the company. After paying £15,515 for mining and general expenses and paying other items, the net profit of the company for the year was £14,144, which, added to £25,090 balance brought in from the previous year, makes a total of £39,235 balance in hand. At about the time when the financial year closed the company took hold once more of the mine with the object of examining the bodies of low-grade ore still remaining in the stopes, so that at the present time there is little being done by the lessees. Owing to the methods of mining pursued by the lessees, involving the extraction of ore without doing any timbering, the mine is caved at many points, and it is probable that the caving system will have to be adopted in removing the remaining low-grade ore. The wet mill for treating the dump is in course of erection, and the first unit for handling 5000 tons per month should be in operation by the middle of February. When some of the dump is cleared away, there will be sufficient space available for erecting the second unit, say in six months time. The combination mill for treating the better-grade ore from the mine should be completed by the first of March. This mill has a capacity of 50 tons per day, but at small expense it can be doubled. The breaker for treating the low-grade ores from the mine is under construction. This breaker will reduce the rock to cubes of three or four inches. The friable ore occurring in very thin veins in this rock will be released as fine, which will be sent to the other mill, while the coarse rock will be thrown away. Mr. Argall estimates that on the dump and in the mine there is ore enough to last for eight or ten years at the rate of 10,000 tons per month, and that the profit should be $1 per ton.

A week or two ago I mentioned the case of the Sulphide Corporation, owning the Central Mine at Broken Hill. This week the reports of two other Broken Hill companies, namely Block 10 and Block 14, have been issued. Block 10 has been a regular dividend payer since 1890, and Block 14 has also paid good dividends, though not so uniformly successful. The two reports just issued cover the six months ended September 30 last. Block 10 company made a working profit of £57,790 and received £10,000 as an installment on the payment for its zinc tailing. Dividends amounting to £50,000 were distributed out of the profits. With regard to the concentration of the ore, it is noteworthy that more stuff now goes over tables than jigs, thus showing a change in the nature of the ore. The lead concentrate obtained showed a recovery of 67.66% of the lead contents of the crude ore, and 36.16% of the silver. The latter is allied chiefly with the zinc and will be recovered with it when the zinc tailing is treated by the zinc people. A very good idea of the nature and duty of the concentrating plant is given by the following statement.

CRUDE ORE TREATED, 73,816 TONS.

	Tons.	Silver, Oz.	Lead, %	Zinc, %
Lead Concentrate	11,596	31.59	60.02	9.86
Zinciferous Tailing.				
Jig Tailing	21,953	6.62	4.11	15.73
Vanner Tailing	6,167	10.39	6.19	22.24
Jig Middling	16,799	9.94	6.18	22.05
Wilfley Tailing	1,751	7.73	4.89	18.96
Wilfley Extension Tailing	1,360	9.15	5.92	19.0
Re-ground Tailing	2,183	8.39	3.6	22.82
Slime	12,043	14.78	10.79	22.8

Block 14 company treated 46,197 tons of sul-

phides and 10,622 tons of carbonate, and made a net profit of £72,490. The average assay value of the sulphides was 12% lead, 9 oz. silver, and 10% zinc. A recovery of 64.9% of lead and 41% of silver was obtained. The lead concentrate was 5924 tons, assaying 61% lead, 29 oz. silver, and 5½% zinc. The zinc tailing is being stored for future treatment or disposal. As I mentioned last week, the directors of the Australian Smelting Corporation have been forced to propose a reconstruction of the company to provide further working capital. The proposition came before a meeting of shareholders this week and an acrimonious discussion took place. Finally the proposition was carried against the dissentients.

Western Australia.

F. A. Govett, chairman of Broken Hill South Blocks Ltd. brought some comfort to the meeting by saying that his company was anxious to give the Corporation its smelting contracts, and he also hinted that there was some probability of the necessary money being found in Melbourne, thus rendering it unnecessary to proceed with the reconstruction after all. Let us hope that his surmise will come true, and that the English shareholders will not be called on to pay up this assessment.

One of the big West Australian companies, the Oroya-Brownhill, has had to announce that its main source of high-grade ore is rapidly dwindling and that for a time the output will have to be reduced. Two months ago, the news was published that an intrusion had been cut in the ore-pipe at the No. 5 level in the Oroya North Block. Since then, further developments have not improved the position, and the rich ore from this part of the mine, on which the maintenance of the present output depended, is becoming rapidly exhausted. There are, however, large bodies of low-grade ore and the company will still be able to pay some very fair dividends.

ROSSLAND, BRITISH COLUMBIA.

Shipments of Ore.—The Granby Co.—Annual Meetings.—Cost of Producing Copper.

Considering general conditions, mining affairs are quite active in this district, although several of the big mines have not resumed work yet. The Le Roi is working steadily and shipping about 1600 tons of gold-copper ore per week; the Centre Star is shipping approximately 3330 tons per week. The latter has a large quantity of good ore in reserve and in

Map of Part of British Columbia.

one of the lodes they have found free gold. Ore taken from this vein and shipped ran $40 per ton. This is encouraging when it is known that the general run of the mine only goes about $13.

The Granby is the only shipper in the Boundary district since the recent close-down. They are shipping about 16,500 tons per day and the smelter is putting through about 17,400 tons per day. It is expected that the seventh furnace at the smelter will be started within a day or two, which will give a total capacity of 3000 tons daily. It is hoped that the B. C. Copper Co. will make a move to resume operation shortly after the annual meeting, which will be held at Charleston, W. Va., on February 11. It is also expected that something will be done at the meeting of the Dominion Copper Co. to be held at Phoenix, B. C., on January 27. However, it is understood that perfect harmony is necessary for the profitable operation of these properties under present conditions. The mine operators, coke and coal producers, and the miners themselves must all pull together, as it costs the Granby about 10.13c. to

mine, smelt, refine, and sell its copper; it costs the B. C. Copper around 12½c., and for the fiscal year ended July 31 it cost the Dominion Copper Co. around 14c. to realize upon its copper. The Hewitt Mining Co., a New York enterprise in the Slocan, has made many improvements and great headway on the properties they have bonded. They have recently shipped five cars of silver-lead ore averaging 141 oz. silver and 5% lead.

The output of the Rossland Mines for the last 14 years has been 2,879,833 tons of gold-copper ore the estimated value of which is $40,279,421. Coal mining and coke-making is quiet in the Crows Nest Pass district. No doubt this is partly due to some of the Boundary mines being shut down, but one coal mine has closed down pending the renewal of a coal contract with the Canadian Pacific Railway Company.

DENVER, COLORADO.

Golden Cycle Mill in Full Operation.—Aid to Mining Schools.—Company Litigation.—Lawsuits Settled.—The Cripple Creek Adit.—Sunday Closing.

The Golden Cycle mill at Colorado City has fired up its eighth and last roaster and is now running at full capacity. The work on the new sampling building for the same plant is being pushed as rapidly as possible. The plant when complete will have cost $1,250,000.

Representative Haggott has introduced a bill at Washington that is calculated to benefit the mining industry. The bill is for the application of a portion of the proceeds from the sale of public lands to the endowment of schools of mining or departments of mining in State educational institutions. The bill provides for the payment to States maintaining such institutions of $15,000 the first year and an additional $1000 each succeeding year until annual payments of $25,000 are reached, which shall be continued thereafter.

The six directors of the El Paso Consolidated Gold Mining Co. have issued a circular answering the charges of A. L. Burris, who is making a fight for control of the company. The reason for giving up the contract on the Cripple Creek adit is stated as inability to make the required progress without a continued loss of money. Mr. Burris has replied to the circular of the directors by issuing his fifth circular to the stockholders. By the time of the annual meeting, on March 9, the El Paso stockholders should be well informed concerning their holdings as they are receiving the benefit of a lively publicity campaign. Several lawsuits have been settled by various mining companies within the last week. Three cases, aggregating $8,100,000, against the Stratton estate were settled by the payment of $4000. Comment upon the greed of claimants is unnecessary. The Portland Gold Mining Co. has been successful in the suit against it by Frederick Herman, a former employee. Herman claimed that the company was using methods patented by him without his consent. The District Court at Leadville has returned judgments aggregating $20,000 in favor of the Fanny Rawlins Mining Co. The suit was brought to recover the value of ore mined by the owners of the adjoining St. Louis claim.

The contract for the remainder of the deep drainage adit at Cripple Creek has been let to A. E. Carlton of Colorado Springs. Fourteen bids in all were received, and in awarding the contract the price, rate of progress, and reliability of the bidders were considered. As there remains more than 14,000 ft. of the original 15,500 ft. to be driven, it will require at least two years to complete the adit, and at $28 per linear foot the total cost will exceed $400,000. No contract has as yet been given for sinking the 600-ft. intermediate shaft.

The Sunday closing movement, started at Cripple Creek recently, has been partly successful. The Mine Owners Association has decided to close the mines on alternate Sundays. There has been a great deal of 'high-grading' in the camp, and after thoroughly discussing the matter, the association decided to leave the installation of the change-room system to the individual operators. While it is not expected that this practice will become general throughout the district, several of the mines will adopt the plan within a short time. The Mine Owners Association has issued 3750 of its new permit cards to miners since September, 1907. This indicates the largest number of men at work for several years.

Nearly all the available territory is now in demand by lessees. L. G. Carlton and associates have secured a two-year lease on the Pharmacist and a lease for a like length of time has been given to Gust Helien and associates on the Maggie claim. The large mines are being vigorously developed. The unwatering now in progress at the Vindicator mine on Bull hill and the Strong and Portland mines on Battle mountain has appreciably lowered the water in the other mines of the district and decreased the quantity flowing from the portal of the deep drainage adit.

BUTTE, MONTANA.

Great Falls Smelter.—Butte-Ballaklava Co.—The Reins Co.—Butte Coalition.—The Fire Underground.—Development of the Raven.

The Boston & Montana Co.'s smelter at Great Falls is now turning out about 5,000,000 lb. copper and 2,000,000 lb. matte monthly. This comprises the total production of the Amalgamated Copper Co. at present, and is equal to the combined output of the Great Falls and Washoe smelters prior to the shut-down of the Washoe. The electrolytic refinery at Great Falls has 376 electrolytic vats, 64 having been added during the past two years. Each vat is 9 ft. 9 in. long by 2 ft. 4 in. wide and 3 ft. 9 in. deep. The works at the Washoe smelter have 1400 vats in sets of 200 each, and the plant has a capacity for producing 9,000,000 lb. refined copper monthly. The Boston & Montana smelter has five blast-furnaces, three reverberatory furnaces, 22 McDougal roasters, 26 gas-producers, and 12 stalls of converters.

The Butte-Ballaklava Copper Co. has completed arrangements for installing a complete electrical plant to take the place of the temporary hoist, which has been in use since the company began shaft-sink-

ing. The equipment will include two compressors, a hoist of the latest design, and a pump for the 800 ft. station, all to be driven by electricity. A new head-frame is also to be erected.——J. M. Guffy, of Pittsburg, president of the Reins Copper Co., has filed for record an annual statement showing that the company has a capital stock of $3,000,000 and an indebtedness of $327,000. More than a hundred liens and attachments have been placed on the property of the company, consisting of the Combination, Ella, and Louise claims.——The Butte-Montana Mining Co., owner of the Alex Scott, reports an indebtedness of $39,190 and $791,507 in capital stock paid in. The company has not been doing any work on its property for some time, but the Boston & Montana Co. is sinking the Alex Scott shaft and driving levels for the purpose of getting a new inlet to the fire zone in the Leonard and Colusa mines.

During the general suspension of mining operations the Butte Coalition Co. is doing some good development work in the Rarus, Minnie Healey, and Tramway mines. On the 1600-ft. level of the Rarus the vein has been cross-cut and a drift is now being run in the ore, which is from 8 to 20 ft. wide, and assays up to 12% copper, the average, of course, being considerably lower than that. A cross-cut is also being driven from the 1700-ft. level, but the vein has not yet been reached. The shaft is down 1800 ft., and 75 ft. more will be added before another station is cut. Drifts are being advanced on the 1300, 1400, and 1500 ft. levels of the Rarus into the Minnie Healey ground and toward the new Tramway shaft, with which connection will be made. On the 1300 a fine body of ore has been opened in the Minnie Healey ground. The vein there is 100 ft. wide. The 1100-ft. level is the lowest working in the Minnie Healey itself, and there will be no connections made between the 1100 and the 1300 of the Rarus until it is certain that all the fire and gas are finally out of the upper workings. Sometime ago the Boston & Montana Co. tried to open the old Minnie Healey shaft for the purpose of using it in the fight against the fire in the old workings, but the shaft caved again and it has been abandoned. The fire is now under perfect control, but the fight to extinguish or confine it to a very limited area will be continued until the purpose is accomplished. In the course of this development work the Butte Coalition is taking out about 100 tons of ore daily, but none of it is being shipped to smelters. It is piled on the ground near the railroad track, where it will remain until there is a bigger demand for copper. The Tramway shaft has reached a depth of 1250 ft., and will be sunk at least 300 ft. more. All the mines of the Coalition Co. are in excellent condition, and when the metal situation becomes normal the company will be in shape for a big production. Most of the mining will be done through the new Tramway shaft.

The Raven Mining Co. has completed the Raven shaft to a depth of 1100 ft., at which point a station is being cut. The vein has not been seen below the 700, but on that level the main vein cut near the shaft on the north side, and a second vein was cut about 61 ft. farther north. The second vein is 26 ft. wide, and carries stringers of ore from one wall to the other, carrying some silver and copper and giving every indication of ore deeper down. The company is also driving a cross-cut on the 900 and expects to reach the same vein very soon. As soon as the station at the 1100 is completed a cross-cut will be driven from that point, and at the same time sinking will be resumed. It is the purpose of the company to take the shaft to a depth of 1500 ft. as rapidly as possible and open the veins at that depth. On the upper levels some lessees have been working and they have taken out some good ore, but the prohibitive rates charged by the smelters lately has interfered with shipments. The company has a large, 20 by 36 in. hoisting engine coming from Pittsburg, Ill., and it is expected to arrive in a few weeks. New skips are also coming. The new engine will be installed at the Raven shaft as soon as it arrives. It will be able to work to a depth of 2000 ft. The old dump near the mine has been hauled away and the ground cleaned up for new buildings. John Berkin, the general manager, is pushing the development work with all possible speed, and he is pleased with the appearance of the mine.

SALT LAKE, UTAH.

Utah Copper Co.—Boston Consolidated.—Honerine.—The Ontario Adit.—The Swansea Mine.—A Suit Compromised.—Yampa Smelter.

At a meeting of shareholders of the Utah Copper Co., at Jersey City, the capital stock was increased from $6,600,000 to $7,500,000; also the issue of $1,500,000 worth of bonds, bearing interest at the rate of 6% and convertible into stock at $20 per share. Following this action, D. C. Jackling, the manager, ordered the immediate completion of the four unfinished sections of the company's concentrating mill, with explicit instructions to have them all ready within 90 days. At the present time eight sections, capable of handling 500 tons of ore per day, are being operated. With the Copperton mill in Bingham canyon, the company will be in shape to handle an output of 7000 tons of ore per day. In a report submitted at the meeting, R. C. Gemmell, the superintendent, made the statement that since the company began production it had extracted from its Bingham mines a total of 1,300,000 tons of ore, and out of this amount, 400,000 had been taken out by means of steam-shovels. The mining costs this month will run about 30 cents per ton. The election of W. B. Thompson and Charles Hayden of Boston as directors is taken to indicate that in the future there will be a close alliance with the Guggenheim enterprises in Utah and Nevada.——The Boston Consolidated mill at Garfield is at work. Some delay was experienced in repairing the injury done to the pumping plant through the bursting of a large water-pipe recently; but the first section of the mill is now turning out concentrate.

Assurance has come from Park City that satisfactory headway is being made with the task of reclaiming the Ontario adit, which has been closed

by caves for nearly three years, greatly handicapping mining operations in the district, it having become impossible to operate the lower levels of the principal mines on account of the inflow of water. It is believed now that the last obstruction has been reached; this fact seems to have been demonstrated by the driving of several drill-holes from a parallel drift to the adit proper, a distance of about 27 ft. A vast volume of water backed by tremendous pressure is issuing from these holes. More holes are to be bored, and it is hoped in this manner to release the pent up waters.

A controlling interest in the Swansea mine at Tintic has passed to Jesse Knight and associates of Provo. Mr. Knight is also a controlling factor in the Tintic Smelting Co., which has under construction a smelter for the treatment of the ores of the Tintic district. The Swansea has been obtained principally for its usefulness as a source of water supply. The mine, however, has ore below the water-level, which is at 900 ft. This ore is particularly desirable for fluxing purposes. The smelter is about three-quarters of a mile from the Swansea mine.——The Colorado Mining Co. has succeeded in compromising the suit brought sometime ago against it by J. W. Wilson, one of the original incorporators. Wilson claimed that he had not received all the stock in the corporation which rightfully belonged to him and sued for $900,000 as the value of the stock and the dividends paid thereon. In compromising, Wilson agreed to accept $4500 in full settlement; the amount was paid him and the suit dismissed. The Yampa Smelting Co. has let a contract to the Allis-Chalmers Co. for two converter stands, blowing engine, steel building, etc., to be added to the equipment of its smelter near Bingham.

MEXICO.

Financial Conditions.—Reduction of Wages.

Many of the papers throughout the country have been trying to make themselves and the public believe that the banks and general business conditions were not affected by the financial troubles in the States, but the last few weeks have shown that at least one of the principal industries of the country has been very materially affected, and that is the cotton goods manufactures, so that it has necessitated a heavy curtailment in production and the laying off of much of the labor, especially in the great mills at Orizaba. And now another grave problem confronts the country in addition to that of the unemployed within its borders. The closing of the mines and various enterprises throughout the southwestern part of the United States has left without work many hundreds of Mexicans of those who migrated to the States, attracted there by the higher wages. Now, however, being without work, they are seeking their homes, but improvident as they always are, they have been able only to reach the border at El Paso, and there they lie stranded, and it is said that many are starving or suffering from sickness and disease brought on by exposure and lack of food. The care and disposition of these is a new problem which the Federal Government and the State of Chihuahua are endeavoring to meet.

Rather anticipating this general over-abundance of the unemployed, many districts have, as at Santa Barbara and Santa Eulalia, in Chihuahua, where wages have been cut from P1.50 to P1.25, taken advantage of the opportunity and reduced the wages to a scale more in conformity with the work done and services rendered. The boom times necessitated many raises to attract labor to remote localities or to induce the general run of Mexicans to work steadily at the most favorable prices. And an even further cut may be expected if conditions do not improve, as there are too many now seeking employment for the companies to continue paying the high wages which the Americans have brought into this country to their own undoing. And it is not only in the matter of wages that the American has thus hurt himself, but be it an apple or an orange, a suit of clothes, a piece of furniture, a horse, some land, or a mine, it matters not what, let the Mexican learn that the purchaser is an American, and up goes the price to double or more. Why is this? Partly because the American has had no better sense than to let the Mexican know that when given a price he always cut it in two as representing only half the price in American money; and also the American, being accustomed to good things in every line, when he sees a thing he likes, he will pay to get it. As a result he is held up, and the Mexican would rather not make the sale than let the American have it for less.

TORONTO, CANADA.

Branch Railroad.—A New Smelter.—News From Cobalt.—Prospects to the North.

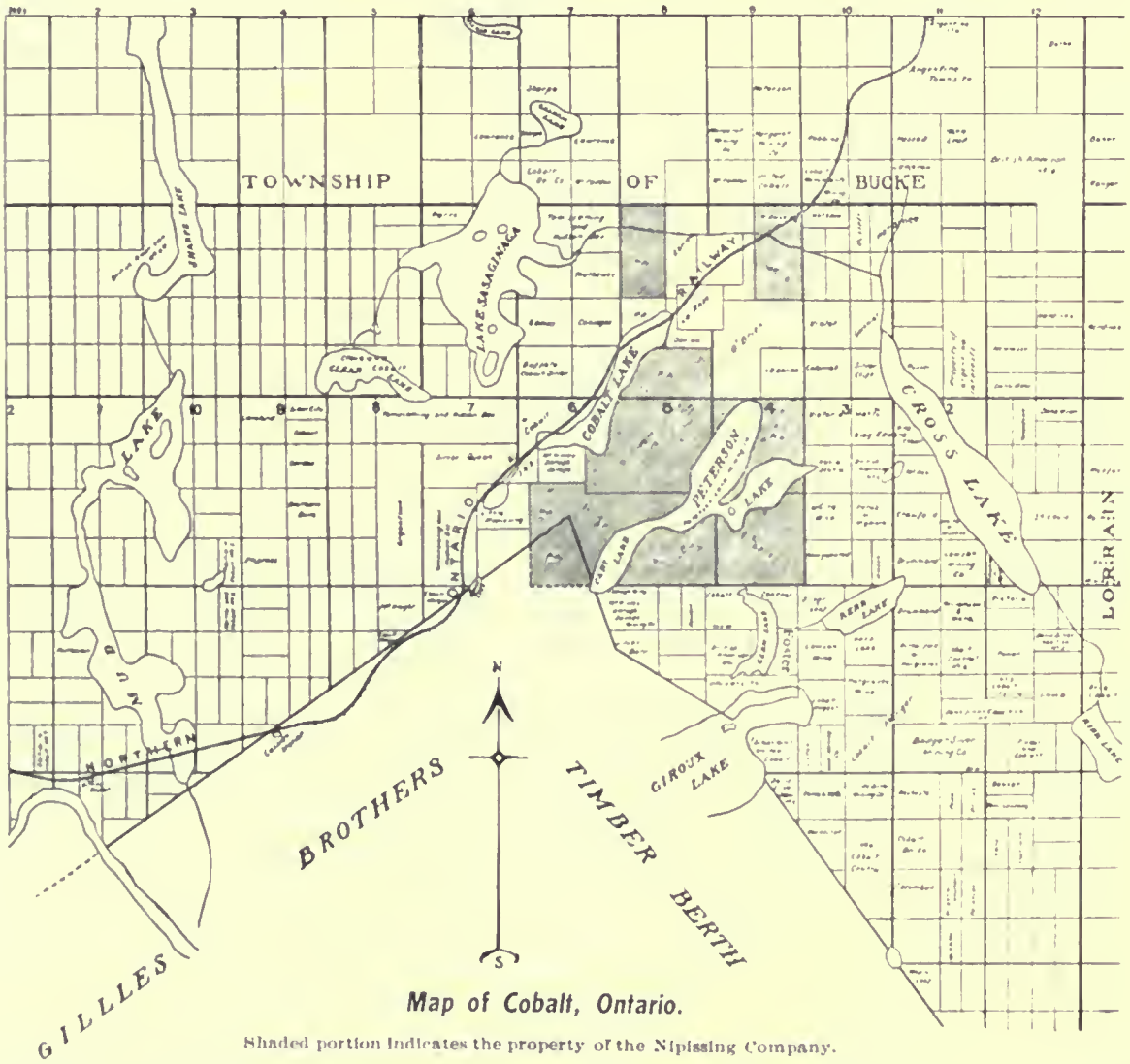
Construction work is being rapidly pushed on the Kerr Lake branch of the Temiskaming & Northern Ontario Railway, which is expected to be completed by the middle of February. It runs easterly from a point about a mile and a half south of Cobalt for a distance of 3½ miles, tapping a number of producing properties, including the Foster, Kerr Lake, Drummond, and University, and giving facilities to the Government mine on the Gillies Limit. Shipments will be made from the Gillies Limit as soon as the branch is completed, a quantity of ore being now in readiness.

The new smelter of the Montreal Smelting & Refining Co. near North Bay, Ontario, erected for the treatment of Cobalt ore, is now completed. The plant, on which about $750,000 was expended, was inspected recently by the Provincial Minister of Mines. The company has exhausted its resources and needs $50,000 to enable it to begin operations and has asked the Provincial Government to assist it in raising the money. Mr. Cochrane promised to lay the matter before his colleagues, but stated that he did not see his way clear to favor the proposal, as there were several smelters in the course of construction.——Shipments of ore from Cobalt for the year 1907 were 14,040 tons as compared with 5129 for 1906.——The Tretheway mine has realized $40,000 on a car of high-grade ore recently shipped. The ore stoped in the east drift of the old workings is valued at nearly $500,000. The vein in No. 2 shaft, which shows 8 in. of No. 1 ore at the 50-ft. level, has improved in value down to 90 ft.——At the O'Brien a vein of cobalt and native silver, varying in width from 3 to 5 in., has been struck at the 100 ft. level.——The Cobalt Contact is preparing to install a new plant, a portion of the machinery having arrived, preparatory to resuming mining operations

on an extensive scale. There are two cars of No. 1 ore awaiting shipment.——The main shaft of the Coniagas is down to the 150-ft. level and development work will be carried on extensively at this depth. Large additions will be made to the plant during the winter.——A good vein has been struck in driving at the Little Nipissing.——Extensive development work at the Red Rock has disclosed large quantities of low-grade ore. The management contemplates the installment of a plant to treat the low-grade ores on the spot, which seems to be the only plan by which the mine can be profitably run.

A prospecting party sent north from New Liskeard July 29 to examine the country up to James bay in the interests of the Trumpeter Syndicate, have reported results to T. H. Brooks, Toronto, representative of the syndicate. They found at Island Portage, on the Abitibi river, a formation similar in character to that of Larder lake. No placer deposits were encountered, but at Little Otter portage and on the boulders and gravel ridges below New Post, on Abitibi, numerous colors were found, but they were too pressed for time to make a close inspection. On the return by way of the Moose and Mattagami rivers they found copper indications between Grand Rapids and Little Long portage on the Mattagami. At Grand Rapids falls the bed of the river runs through extensive iron ore deposits about 100 miles north of the Grand Trunk Pacific route. They believe that close prospecting at several points on their route would reveal gold in paying quantities.

The official output of Cobalt has been announced as 14,813 tons, shipped by 29 mines during the year 1907. A few isolated shipments are made during the year from other shipping points than the town of Cobalt. The absence of these shipments from other tables accounts for the fact that the table now offered shows nearly 300 tons more than any other table published. The Cobalt Lake Co. has three carloads of ore ready for shipment and was entitled to rank among the shippers for 1907. Its managing director has however made no smelter contracts, and as the company has ample funds on hand for necessary development, it has been decided to store the ore in hopes of an increase in the price of silver.



Map of Cobalt, Ontario.

Shaded portion indicates the property of the Nipissing Company.

Total Shipments from Individual Mines in 1907.

	Tons.		Tons.
LaRose	2,851.02	Drummond	104.13
Nipissing	2,539.39	Green-Mehan	98.39
Coalagas	2,447.61	Cobalt-Central	77.33
O'Brien	1,436.76	Temiskaming-Cobalt	67.25
Buffalo	1,240.93	City of Cobalt	50.61
Tretheway	833.56	Silver Leaf	47.26
McKinley-Darragh	767.25	Colonial	40.38
Silver Queen	456.55	University	36.00
Foster	368.93	Watts Mine of King Edward group	31.17
Kerr Lake	323.19	Nancy-Helen	30.15
Nova Scotia	246.46	Red Rock	20.00
Temiscamingue	224.41	Imperial (Evans)	18.95
Cobalt Townsite	143.22	Princess	3.25
Tem. & Hud. Bay	180.41		
Right of Way	128.57		
Total tonnage for 1907			14,813.13

Year.	Tons.	Value.	Year.	Tons.	Value.
1904	158	$ 136,217	1906	5,129	$3,900,000
1905	2,141	1,473,196	1907	14,813.13	5,650,000

Concentrates.

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

NO DUTY is collected on graphite imports.

THE study of the origin of ore deposits has a practical bearing on prospecting and on the valuation of mining properties; hence, theoretical studies should be welcomed by practical men.

THE deepest diamond-drill hole on record was put down in Upper Silesia in 1900 and reached a depth of 6700 ft. On the Rand, in South Africa, a Sullivan class P drill bored to 6340 ft. in 1905.

A DEPOSIT OF BISMUTH ORE of sufficient size to make its mining on a large scale worth while, would yield sufficient of the metal to reduce the market price to much less than it has been in recent years; but it is possible that if the market were not artificially contracted, and the metal were mined and smelted without restriction, new uses would be found for it, and manufacturing on a large scale might become a commercial success.

IN MEXICO ore is generally sacked so that the packages may weigh from 140 to 155 lb. each. Two of these make a load for a burro. When the ore is very heavy the two sacks that are packed on one burro may weigh nearly 200 lb. each. The trails are mostly down grade or level, with occasional short and steep or longer and more gradual ascents. The animals work under these loads for months without any apparent ill effect.

UNSLAKED OR FREE LIME is the greatest enemy of good portland cement, as its presence will cause the mortar to disintegrate gradually. To determine the presence or absence of harmful constituents a very simple test may be applied. Two pats of cement (without sand) should be mixed to the consistence of putty and placed on glass. Make them about three inches across and half an inch thick at the centre and tapering to a thin edge. Cover with a damp cloth for one day, then put one pat in water and let the other stay in air, preferably moist air. If the pat in air shows large yellow blotches after a time, or if the pat in water begins to show cracks, starting at the edge and running toward the centre (showing disintegration), the cement is not up to the standard.

COPPER ORES often contain deleterious minerals which cause trouble in their reduction. Bismuth is quite troublesome in some Australian ores, although since the general introduction of electrolytic refining it has ceased to be as objectionable as formerly. Arsenopyrite is a very common and obnoxious associate of copper ores; the same is true of antimony minerals. They are partly eliminated in modern smelting methods but only by the electrolytic refining process can the copper be made pure enough for electrical uses. Zinc, usually present in sphalerite, is the most obnoxious associate of copper. It is so troublesome in ordinary copper smelting that usually each percentage in excess of 10% is charged for at the rate of 25c. per unit; this is known as the 'zinc penalty.'

ELECTRIC HAULAGE is used underground at the Wesselton mine of the De Beers Consolidated Mines, Ltd. company, in South Africa. Electric trains, composed of 6 to 8 mine cars, each of 1 ton capacity, run at a speed of 15 miles per hour even around curves of 55 ft. radius; this is possible because the track is laid with 45-lb. steel rails with manganese steel fittings, points, and crossings. The motors have broad, flat, beak-shaped ends and resemble some types of racing motor-cars. The loaded cars are automatically tipped into capacious ore-chutes by running them over a curved rail placed at the exact angle necessary to tip over the loaded car and then let it fall back into its place again after emptying. The cost of electric transportation over a system having one-half mile run amounts to 1½d. per ton.

SOME idea of the cost of operating a mine in the outlying districts of Nevada may be had from the following list of prices of labor and material now in force at Manhattan, Nye county: Miners, driving, and trenching, $4.50; sinking or raising, $5; work in wet places, 50c. extra per shift; tool-sharpeners and blacksmiths, $5.50; timber-men, $5; hoist-engineers, $5.50; stoping, $5; machine-work, 50c. extra; all contract work, $1 more than company work. All prices for eight-hour shifts. Overtime is allowed only in cases of extreme necessity. Board costs $45 per month, rooms $10. Candles cost $7.50 per box; powder, No. 2 Hercules, 16½c. per lb.; No. 2 extra, 17c. per lb.; 3x caps, 90c. per 100; 5x caps, $1.25 per 100; fuse, (Bear), $33 per case of 6000 ft.; gasoline, Red Cross or Motor, $5.65 per case of 10 gallons; kerosene, $5.75 per case; drill-steel, 14c. per lb.; steel rails, 7c. per lb.; blacksmith coal, 5c. per lb.; wire nails, 9c. per lb.; rough lumber, $75 per 1000. These are net prices charged by local merchants, when goods are purchased in quantity.

A CONVENIENT METHOD for thawing powder at a small property where a gasoline hoist is used, is the following: Have a tank made large enough to hold a small water-tight powder-box, with plenty of room for water around the sides, top, and bottom. Tap a hole and put a turn-cock just above the engine-cylinder, in the vertical pipe that conveys the cooling-water from the cylinder to the cold-well. A small funnel and pipe will then convey this hot water from the engine-room to the thawer outside. If water is scarce, it may be drawn from a cock in the bottom of the larger tank, and returned to the cold-well after it has lost its heat. If the engine is not running enough to heat all the circulating water, turn off one of the valves in the circulation pipes, and boiling water will soon be had. If one charge of hot water does not soften the powder, two charges will probably do the work. In this way the powder is never near a fire, does not come in contact with any water, and no danger is incurred in the process.

THE rapid rise in the price of antimony in 1906 was not due to the exhaustion of mines as some supposed, but to the fact that the ore treated at important metallurgical works in France and Italy was largely converted into oxides and other salts, instead of into regulus as formerly. Both the Italian and French governments encouraged the use of antimony pigments, which have the advantage over white lead of being innocuous, and over zinc paint of being permanent and sun proof. The protection of these governments and a growing demand in England for antimony pigments caused the Société Anonyme Franco-Italienne to increase its paint production at the expense of the regulus output; other companies probably followed its example. At the same time there was an increased demand for the metal in the machine and industrial world, where antimony is obtaining a wide application in the manufacture of bearing-metal and other alloys, and is replacing soft lead for acid-proof linings, and for other purposes.

Discussion.

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy.

The Mechanics of Ore-Crushing.

The Editor:

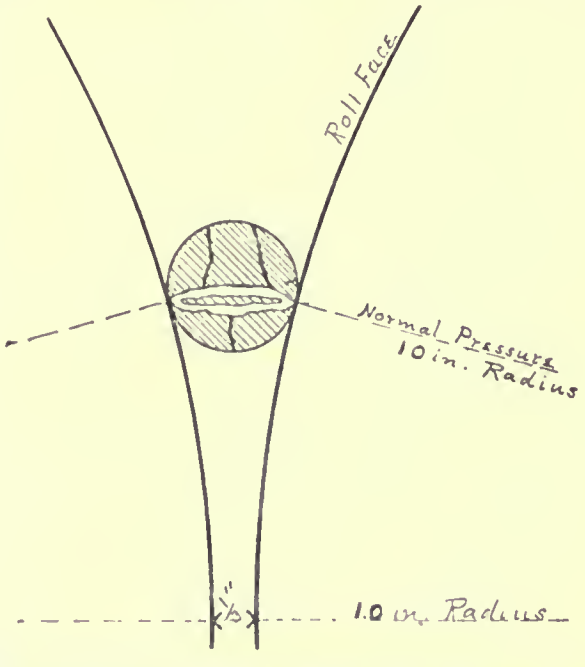
Sir—Mr. Ernest A. Hersam, in his paper on 'Economy of Power in Crushing Ore,' in your issue of November 16, has passed in review a large number of the conditions present in ore-breaking and comminution, and his paper in consequence is full of valuable suggestions. It may be taken as a starting point for a more exhaustive examination of the subject. This, however, necessitates the accumulation of experimental data, and only by such investigation can true and useful conclusions be drawn, capable of convenient expression in the form of working formulae. In the absence of such data the mathematical deductions presented in the paper can only be considered as applying to a very special set of conditions, and it is to be hoped that Prof. Hersam, with the laboratory facilities at his command, will extend his researches, and lead the way to a clearer comprehension of the phenomena of crushing, and of the economical application of power to produce desired results.

Although we have to deal with mixtures of irregular masses of many sizes in the practical crushing of rocks and ores, it is obvious that the initial step toward an understanding of the mathematical effects produced under complicated conditions can best be reached by an examination of the phenomena of crushing single masses of symmetrical shape. The average shapes of rock-fragments are approximately either spheroids or ellipsoids. The behavior of ore particles settling in water confirms this. Such being the case, we may properly begin our study by subjecting spheres to strains similar to those induced in ore-particles in practical crushing.

It has been my privilege to conduct a few experiments of this character, which were unfortunately interrupted before sufficient data for safe generalizations had been obtained. The results, however, were so uniform under similar conditions, and so different from those anticipated from theoretical considerations, as to emphasize the need of a thorough experimental investigation of the subject. As an example, it was found in the crushing of glass spheres 1 in. diam. in rolls set ½ in. apart, that with only a few exceptions in several hundred experiments the sphere ruptured into six principal pieces, five being relatively large fragments with irregular fracture-planes or surfaces, and one being an elongated fragment the length of which almost equaled the entire distance between the points of contact of the opposing roll-faces with the original sphere. The large fragments could be refitted in the great majority of cases so as to re-establish the sphere, which was then found to contain a hollow space having the form of an elongated ellipsoid terminating in small round openings at the points of contact with the roll-faces. The elongated fragment had come from this hollow space, which, however, it did not completely re-fill. A considerable quantity of small fragments and finely pulverized material had been produced in the interior of the sphere between the elongated fragment and the larger pieces. The volume of this interior ellipsoidal cavity, as determined by displacement of water, averaged about 10% of the whole, and the volume of the elongated fragment was about 4.5% of the entire sphere, leaving about 5.5% of relatively fine comminution as the result of a single passage of the sphere through the rolls.

In effect the tendency of the sphere under compression had been to behave as a beam between the points of application of the force, and to shear off all that portion not acting as such beam. Moreover the shape of the elongated fragment was approximately that of the figure produced by the lines of distribution of strain within a beam, as experimentally determined when compression is applied to the two ends thereof through simple points of contact.

It was also noted that the larger fragments commonly showed incipient concentric fracture-surfaces indicating the transmission of spherical waves of compression, starting from the points of contact with the rolls, and widening out therefrom. Exactly similar results in all details were obtained by crushing such spheres in rolls and in jaw-crushers. Subsequently, selected Baltic pebbles were crushed under like conditions, yielding similar results, sometimes as perfect as in the case of the glass spheres, but original planes of weakness in the pebbles usually modified the forms of the fragments materially. Selected pebbles of granitoid rocks from glacial moraines gave results more nearly approximating those with the glass



balls, except that the elongated fragment was more irregular in outline.

Very different results were obtained in crushing by stamps. In these experiments steel bars ¾ in. high, were placed in the die upon either side of the spheres, which were 1 in. diam. The stamp accordingly came to rest upon the steel bars; the crushing effect thus being due solely to impact of the falling stamp upon the sphere. The weight of the stamp was 850 lb., and height of drop to the steel bars 7½ in. In all cases the upper portion of the sphere was irregularly fractured, the lower portion was reduced to small particles and in the centre, in contact with the die, was found a quantity of finely comminuted material. Manifestly the comminution had been due to rupture produced by strains set up by reflected waves of compression meeting oncoming compressive waves.

Further experiments on the crushing of granite, syenite, and many varieties of ores, with and without disseminated sulphides of iron, copper, and lead, brought out a few surprising facts. It was found that materials that had been kiln-dried until they contained less than 2% moisture, yielded sizing-curves which were practically coincident when similar crushing conditions had been maintained, irrespective of the mineral composition of the material. It was also found that, when reducing ores in the normal way in rolls, intermediate screening out of

material finer than No. 28 mesh (0.6096 mm.) between successive crushings did not affect the sizing-curves of the total resultant product. It was further observed that the quantity of fine product rapidly increased with the quantity of water of imbibition in the ore up to about 7%. No measurement of power consumed was attempted, but sufficient has been stated to indicate how far we probably are from accurate knowledge of how mineral aggregates behave under the conditions of crushing, adequate for generalization and reduction to mathematical expressions. Systematic experimental investigation of these phenomena would undoubtedly lead to results of immense practical value.

COURTENAY DE KALB.

Los Angeles, December 21.

Variations in Mining Costs.

The Editor:

Sir—Referring to Mr. J. R. Finlay's article in your issue of January 4, there is no doubt that the cost of treating ore should include all the items of expense entailed in the production, for after all the question is simply a matter of a return for money invested. No one goes into mining for the mere scientific knowledge that can be gained from operating, but entirely as a productive enterprise. Some expect quick returns, while others are satisfied with a fair interest. Mining for the precious metals has always had an element of uncertainty. We can estimate with fair accuracy the amount and value of ore already blocked out, but it is different to estimate the cost of finding other ore of equal value and the cost of its reduction, for conditions are changing. While the cost of exploiting and extracting the precious contents may be lessening by improved machinery, the difficulty due to increased depth and impoverished ore at greater depth may more than offset this decrease.

Work already done need not necessarily enter into the calculation of future exploitation at so much per ton, unless an equal amount of work is necessary to block out an equal amount of ore; in other words, the cost of development work should be that necessary to supply for every ton worked out another ton in its place. No two men look at a mine in the same light as to the method of future development, and consequently they will not necessarily agree as to the cost per ton of such development. The fact that a certain number of feet of opening was necessary to develop a certain amount of ore is not an argument for the same quantity of ore requiring the same amount of work.

Looking at it from the standpoint of the mine managers, I desire to point out to consulting engineers particularly that we are the meaus through which their estimates are put to the test, and that in all fairness we should be provided with the figures and means by which the anticipated results are to be obtained. An engineer figures out costs at so much per ton, having in mind the use of certain appliances and processes, but the superintendent may not have the good fortune to be provided with the means of applying these up-to-date methods. He may be compelled to use hand-labor where machine-drills were figured on, and so forth.

The variation in cost is so wide that the personal equation is the important factor in the estimate. Within the last two years I have known mines where the cost of mining and marketing ore varied from about $100 per ton at Cobalt, $14 per ton in Colorado, to $3 per ton in California. These costs varied with the size of vein, hardness of rock, amount of picking, efficiency of labor, and many other factors, the most difficult to estimate in advance being the cost of developing another ton of ore. This can only be gained from experience in many localities by the character of the deposit, and at best such a calculation is only a rough estimate, for nature has not provided a glass case by means of which the hidden recesses of the earth can be viewed, so I say: Gentlemen of the profession, kindly let this estimate include all possible contingencies so that the superintendent may be able to come up to your expectations, or it may happen that you will be the one to prove or disprove your own figures.

Generalizations are often misleading and may be derived from experience in a particular line, and while Mr. Finlay's observations may have led him to believe that high development costs are particularly characteristic of non-concentrating mines, it would be unwise to let this generalization influence an estimate unduly; rather, let us look the problem squarely in the face, tabulate facts, and make our figures accordingly.

ALGERNON DEL MAR.

San Francisco, January 16.

Psychology of Mining Booms.

The Editor:

Sir.—I have read with great interest the article by Mr. J. H. Curle entitled 'Psychology of Mining Booms,' which appeared in your issue of January 4. The interest aroused decided opposition to the views expressed and leaves a desire for contradiction.

You, as editor, in saying that you are "in accord with the tenor of his preachment," properly reflect, I judge, the opinion of a majority of the readers of the Mining and Scientific Press. It is this opinion, which I feel is pretty generally held by technical mining men, rather than the individual expressions of Mr. Curle, that I am anxious to combat. But 'Psychology of Mining Booms,' with its blunt effective statements, will serve as the convenient skeleton for me to clothe with the garment of objection.

I utterly oppose the general tenor of Mr. Curle's expressed views because, while one cannot misjudge their good intent, they are dangerously misleading and if accepted would impair many splendid and reasonable opportunities for profit and largely hinder the progress of metalliferous mining. I might also object because these expressions of technical mining men would seem to class the average investor, in their minds, as a brainless idiot. But this may not be intended although if one reasons it out from the Curle type of argument one must arrive at the conclusion that technical mining men consider the public fools and themselves the only ones to whom the Eastern star is visible.

Mr. Curle enumerates the mining booms with which he has become familiar and then says:

"These thirteen mining booms, following upon discoveries of more or less value, took without exception one definite course. After an initial period of scepticism results from one or two mines in the new district led to great financial excitement, and to wide advertisement. Outside promoters entered the field, and capital poured in; for one good mine twenty worthless ventures were floated; the shares, good and bad, rose to absurd prices; and the facts became obscured in an atmosphere of lying and brainless optimism. Then, sooner or later, came the crash. This was always thorough, and in

each case dragged down thousands of more or less foolish and deluded people."

Much more is said, but the pith of the article is contained in the above. It is evident that Mr. Curle does not believe that the discovery of one or two rich mines in a new district warrants financial excitement, wide advertisement, the investment of capital, speculation or optimism. It is with this view that I beg to differ. I submit that when results (proof of richness) from one or two mines in a new district are obtained, those to whom the opportunity is given would be perfect ninnies were they to fail to grasp the chance to acquire ownership in as much of the territory in the district as possible even though the cost might be out of all proportion to visible values. It is a speculation, of course, but one reasonable enough when one remembers that in all the boom camps of recent years the obtaining of results from one new mine has led to the discovery of many others.

In Cripple Creek the original discovery was made by Bob Womack. He staked the Gold King claim on Tenderfoot hill and subsequently a score of other properties, scattered over an area of several square miles, were opened up. They have yielded a hundred millions odd, to which the Gold King itself has contributed a comparatively small fraction.

In Tonopah the original discovery was made by Jim Butler when he staked the only visible mineral-bearing outcrop on Mt. Oddie and called it the Mizpah. Although other operators in this field had no veins to follow, their extensive development work has resulted in the opening up of a number of rich mines.

In Goldfield the original discovery was the Combination, staked by Myers and Murphy. The Mohawk, Jumbo, Florence, Sandstorm, Daisy, Red Top and several others were all subsequent discoveries.

In Bullfrog the original discovery made by 'Shorty' Harris was far distant from such properties as the Mayflower, Shoshone, Tramps, Homestake, Victor, Gold Bar and others. It is these latter properties which have made the district more permanently famous but they were discovered as a result of the location of the Original Bullfrog.

In Fairview the original discovery was rich float because of which many locations were made. The first location has not yet proved to be a mine but later prospectors opened up the Nevada Hills, Fairview Eagle, Eagles' Nest, Mizpah, and others.

In Manhattan the finding of rich ore on the Stray Dog, located by Seyler and Humphrey, has been followed by the development of other and more productive properties.

At various times the discoveries made in the Nevada camps enumerated have resulted in the finding of ore at many other points in the State, such as Round Mountain, Wonder, Gold Mountain, Rose Bud, Lee, Ely, Seven Troughs, et cetera.

In Cobalt the original find was made by McKinley and Darragh, who staked the rich mine of that name. Since then a number of other mines, including the famous Nipissing, carrying extraordinarily rich silver ores, have been opened up.

To summarize, we find that in six out of seven of the most recent boom camps—Cripple Creek, Goldfield, Bullfrog, Fairview, Manhattan, and Cobalt, more productive and more profitable mines were discovered after the original discovery was made, while in Tonopah alone the richest was discovered first and even here subsequent developments have opened up other rich dividend-paying mines.

Therefore I argue, aye insist, that after results have been proved in one property in a new district, optimism, advertising (dissemination of news), excitement, speculation, and advances in prices far beyond visible or proveable values is warranted. The district where one good mine is proved is the best place to try to find another. History perpetually repeats itself in giving proof of the fact that where one rich property is located others exist. So when one rich mine is found, the speculative value of the surrounding prospective territory becomes immediately and enormously enhanced. That an increase in these speculative values may be reasonably extended over territory for several miles from the original discovery is amply illustrated in the case of Cripple Creek, Bullfrog, and other camps. Stratton's Independence is three miles from the Gold King; the Montgomery Shoshone is four miles from the Original Bullfrog—and in other instances the distances between proved mines can be measured by miles. In all cases what may have been barren and worthless mountains or desert space assumes a considerable monetary value which in many instances it is, on a speculative basis, reasonable to pay.

Consequently when I see miners turning their capital and effort toward the development of prospective territory in a new camp; when the investor puts his money into the purchase of a property or acquires an interest in the same through stock purchases, I cannot class them as operating "in an atmosphere of lying and brainless optimism." Will Mr. Curle and the supporters of his argument say that the scores of operators in the camps I have named won success because "lies and foolish imaginings flourish." This certainly is the tenor of thought in 'Psychology of Mining Booms,' as it is made to apply to 90% of those who win fortune, for it is obvious that fully nine-tenths of all the big finds are made subsequent to the original discovery. According to the Curle theory, Stratton, because he chose to delve and prospect in Cripple Creek after the Gold King had been located, or the syndicate of Salt Lake capitalists who bought the Boulder claims (Nevada Hills Co.) for $5000 after Norton had discovered rich float two miles from the property, were "obscured in an atmosphere of lying and brainless optimism." I submit that one cannot argue that only those who were successful were wise while all others were possessed of "foolish imaginings." In my opinion Hayes and Monnette, who made millions out of the Mohawk, were no wiser speculators than the operators upon adjoining ground who may not have earned a penny of profit. Both undertook a reasonable speculation because each was operating in a camp where a rich mine had been proved.

Furthermore, I ask, are we to stop when results from one or two mines in a new camp have been obtained? Is it not reasonable to suppose that where one rich mine has been discovered another may be found? And if we have an ounce of business venture, of speculative instinct within us, would we not be like the much compared bumps on a log were we to fail to grasp such reasonable opportunities did they but come to us? How quickly the discovery and development of new mining camps would dwindle and how few would make profits from mining were investment to keep pace only with the theories of the technical!

And one of the theories of the technical mining man, who is so vastly useful in his own sphere, is expressed by Mr. Curle when he says that thousands of more or less foolish and deluded people are dragged down by investment in mining. The professional mining man seems to believe that spread over this fair land of ours there are thousands of people who have been financially ruined through investment in mining. He also delights to imagine that they are of the brainless optimist and foolish imagining type fit for little else than the insane asylum. As a matter of fact, your average investor in mines or mining stock is an average business man of average sense—neither better nor worse than the average professional mining man. Furthermore, these investors know what they are doing; know that they are speculating—taking chances with their money. They are not blind to the possibility of loss but are alive to the opportunity for gain. And they comprehend these things because they are men of average sense.

I see no justification for criticizing those who put their money into mining property or mining stocks in boom times nor those who encourage such investments along legitimate lines. There is certainly much greater opportunity for profit when speculation is rife and the stock market active than when things have settled down to a routine basis. As the Mining and Scientific Press so often insists, money put into mines is speculation, not investment. This being so, is it not good judgment to operate when speculation is most active, which is in boom times? No business or industry ever introduced was so organized that everyone could make profit from it all the time. In mining some lose and some win the same as in every other walk of life where money is risked for the purpose of making profit. The investing public understands this and only the few 'squeal' when the loss is legitimate. I can readily imagine the criticism which would be forthcoming were the development of the mining industry left to technical men. They would naturally turn the opportunity of acquiring every newly discovered mine to capitalists only. The public would be left out in the cold. The profits of mining would enrich only the few and prospecting would be discouraged because with a limited market buyers could control prices.

It seems to me that Mr. Curle's theories are not based on good reason. He rails at the laws of Nature which control these things and calls it immoral. If we look beneath the surface and judge the matter from all sides—from the human viewpoint of the common people as well as through technical eyes we will find that the laws of Nature in this case, as in all others, can be trusted to be logical and do the greatest good to the greatest number.

CLAUDE SACHS.

Denver, January 13.

Tube-Mill Lining, Slime-filters, and Patents.

The Editor:

Sir—About three years ago, I used an old boiler, 40 in. in diameter, to make a tube-mill for working cemented gravel, by putting six 4-in. angle-irons lengthwise inside, with the idea that the stones would jam between the angles and form a lining which would prevent wear on the boiler-shell. I made heads for each end, and the necessary trunnions, gear, etc., for running it with a horse-whim. Unfortunately, the high-grade gravel gave out by the time I had finished the mill, and it lies in the scrap-heap behind the shop.

During the winter of 1906, when considering the question of re-lining our tube-mill, I designed a lining, to be made in our local foundry, of hard iron (from worn out shoes and dies). This lining was designed in four segments, 4 in. wide, forming a circular arch fitting tight around the inside of the shell, with 16 partitions raised 3 in. and set lengthwise of the shell. These partitions were thickest at the inner end, so that the spaces between them were in the form of a dove-tail; the idea being that the pebbles would jam in these dove-tail spaces and form a pebble lining.

Sometime in the spring we had a very pleasant call from Charles E. Rhodes, general manager of the Waihi mine in New Zealand. We spoke of tube-mills and I made a rough sketch of my idea of this iron lining, and mentioned the fear I had of its working loose unless bolted in. He told me it would stay in without bolts, as their superintendent, Mr. Barry, had invented the same thing and was using it, only instead of waiting for the pebbles to fill the spaces he filled them with flinty quartz from the mine, held in cement.

On July 28, 1907, there appeared in the MINING AND SCIENTIFIC PRESS, a description and drawing, together with an abstract, of Mr. Barry's patent tube-mill lining. It is called 'honeycomb' evidently because the spaces in the castings are similar to the cells of the honeycomb. There is no date given for the patent, nor does it state the country from which it was issued. At the April meeting of the American Institute of Mining Engineers a paper was presented by E. G. Banks describing this same honeycomb lining.

On October 12, 1907, there appeared in the Mining and Scientific Press a description, with drawing and photograph, of a cast-iron lining for tube-mills in use at the El Oro mine in Mexico. In many ways it is similar to Barry's.

On November 23, 1907, in the same journal, under the head of 'Tube-Mill Lining,' an article was published describing a similar lining, with quotations

from a Mexican patent of February 22, 1907, granted to H. W. Hardinge.

On December 21, 1907, there appeared a letter from C. E. Rhodes referring to that of November 23, giving a photograph of the interior of the El Oro tube-mill and stating that "said liner has been in use in the El Oro mills for over two years."

On the same page is a letter from the Blaisdell Company, stating that reference to the U. S. Patent Office files will show that on June 13, 1906, Joseph Rodney Brown of Los Angeles (formerly of El Oro) applied for a patent on lining for grinding-mills, which was issued on August 27, 1907. Quotations of specifications from Brown's patent are given which would apply equally well to Barry's.

In May, 1907, Edwin Letts Oliver, who has charge of the cyanide work at the North Star mines, Grass Valley, constructed a small working model of a continuous slime-filter, which may be described as a revolving drum about two-thirds submerged in thickened slime. On the circumference was the ordinary filtering material and through the trunnions an arrangement to produce a partial vacuum or a pressure of air. On the outside of the filter a knife was fixed to scrape off the filtered material. This model did so well that work was immediately started for the construction of four drums 6 ft. wide and 6 ft. in diameter. Soon after the drawings were made, and the orders out for their construction, we had a visit from Jas. W. Neill, of Salt Lake, who was much interested in slime-filters. On seeing a sketch of our scheme he remarked that it would work all right, but we could not get a patent on it; the manufacturing chemists had been using exactly the same thing for fifteen or twenty years. As we cared nothing about the patent, it was enough for us to have the assurance that the machine would work.

Within a few weeks, on November 9, 1907, a letter was published in the Mining and Scientific Press from Askin M. Nicholas of Australia, accompanied by a drawing, stating that a U. S. patent had been granted him in February, 1899, for a slime-filter. The drawing showed a machine strikingly like the one we were constructing, and a month later, or December 7, the same paper published the patent specifications. Except in detail of construction, these patent specifications would equally well apply to our machine.

On August 24, 1907, there appeared on the front cover of The Engineering and Mining Journal, a large advertisement as a "Slime Announcement. Users and prospective users of **submerged suction** or **vacuum** or **submerged pressure filters,** are hereby informed and **warned** (black type copied) that the last three years litigation involving the well known Moore Filter Patents for treating slimes has come to an end, with the result that all rights, titles, interests and claims to these fundamental patents now rest in this corporation, of which Mr. George Moore (the inventor) is general manager. While this litigation has been pending, numerous installations under many different patent claims and titles (all clearly evident infringements) have been made and are in successful operation all over the world.—— The policy of this (new) corporation is to promptly suppress all infringements. For full particulars address the Moore Filter Company."

On the inside of the cover of the MINING AND SCIENTIFIC PRESS of January 11, 1908, is an advertisement of 'The Filtration of Slimes by the Butters Method.' Among other things it states, "We are working under valid American and Foreign Patents and shall protect our customers. The Butters Vacuum Filter Company."

The Kelly Patent Filter Press has been advertised for several months, and there is also the Burt and the Rapid. Grothe's great pressure-filter in Mexico—a splendid adaptation to conditions—I believe is not patented. In the patent announcements of your January 11 number, however, is a revolving filter which might be intended as a copy of Mr. Nicholas's, showing that the patent industry is still thriving.

In the matter of the tube-mill lining, it seems to me that Mr. Barry should have the honor of being the first to make an iron lining holding the pebbles for pebbles to grind on, though Mr. Brown, Mr Hardinge, and even I, may claim that our ideas were equally original, but they came later.

As to the filter, there can be no doubt that Mr. Nicholas was the first to use the submerged filter, with air to blow off the cake, for stamp-mill slime, but there were the manufacturing chemists using the same method for getting their soda ten years before. Mr. Moore, Mr. Butters, Mr. Kelly, and Mr. Oliver are undoubtedly entitled to originality of ideas, but they came later than Mr. Nicholas and most of them had original ideas in the details of the methods used and not as to the broad use of the process.

"Render unto Caesar the things which be Caesar's." Without brag or threats, the priority in these matters seems to rest with our modest friends, the alert engineers of Australia and New Zealand.

But amid the mass of patents and claims, the forgotten man is the mine manager, who, after all, is the man who makes success or failure for the patentees. He is in desperate trouble because his tailing is running down the gulch carrying gold, perhaps enough to make all the difference between profit and loss, and yet, when he reads the various patents—or the advertisements—he hesitates about putting in a slime-plant, lest the patent lawsuits worry him more than the loss in the tailing. Possibly it would be better business for the patentees and manufacturers to offer a few words of encouragement to the miner, and, instead of threats of suppression and dire calamities, use soft words to induce him to adopt their special machinery or process because it is better or cheaper than others. For it may occur to this miner, that tube-mills and vacuum-filters and pressure-filters were in use long before the present generation of inventors was born, and whereas patents may issue without thought and without number, he may conclude that "a dream cometh through the multitude of business, and a fool's voice is known by the multitude of words."

ARTHUR DE WINT FOOTE.

Grass Valley, California, January 17.

Analysis of Production of Two Great Copper Mines.

Written for the MINING AND SCIENTIFIC PRESS
By an Occasional Contributor.

CALUMET & HECLA.—In 10 years ending on April 30, 1907, this property produced 427,649 tons of fine copper.

Paid.....$52,500,000 dividends.
Invested ..... 9,878,000 in new property.

Total real earnings $62,378,000

Copper averaged.....15.45 cents per lb., or $309.00 per ton
Earnings " ..... 7.30 " " " " 146.00 " "

Cost ..... 8.15 " " " " $163.00 " "

The content of copper recovered from ore sent to mill diminished from 60 lb. per ton in 1897 to 41.7 lb. in 1907, but in 1907 one-sixth of the output came from the Osceola lode, which carries only 32 lb. per ton.

Cost of mining was in '97, '98, '99 .....$4.80 per ton
" " " " " '04, '05, '06 ..... 3.50 " "
Cost of copper remains the same.
Investments made by this company will prolong its life.

If Lake copper will continue to average 15¼ cents, which I think is likely, this mine ought to be able to pay $5,250,000 per annum, besides laying aside $1,000,000 per annum to add to its investment of $9,000,000 in contiguous territory. These investments ought to average a return of 10%, and in 10 years an enormous surplus could be built up, insuring the future of the property. See record below.

*Year.	Fine copper. Tons.	Price. Cents per lb.	Dividends.	Spent in purchase of new property.	Balance of assets.
1898.....	41,960	11 —12	$4,000,000	.....	$6,558,456
1899.....	43,879	12 —18½	7,000,000	.....	4,398,544
1900.....	44,548	18½—16	8,000,000	.....	4,260,858
1901.....	37,933	16½—17	6,500,000	(Fire)	2,168,130
1902.....	42,462	16⅜—11	4,000,000	.....	3,592,779
1903.....	42,216	11¼—15½	2,000,000	.....	6,557,023
1904.....	41,612	11¾—13¾	4,000,000	.....	6,583,038
1905.....	43,090	12½—15½	4,500,000	12,000 acres timber land $184,859	7,144,000
1906.....	43,652	15½—19	5,000,000	9,223,395	10,629,819
1907.....	46,297	18¼—26¼	7,500,000		7,028,942
Total...	427,649	15.45	$52,500,000	$9,408,254	.....

*The fiscal years end on April 30.

Investments and increase .....$ 9,878,740

Total earnings $62,378,710

1888—Milled 814,000 tons for 50,295,721 lb. Copper, 61½ lb. per ton.
1898—Costs $4.05 per ton.
1899—Milled 1,500,000 tons for 87,758,000 lb., or 58 lb. per ton. Cost this year was $5.65 per ton.
1900—Cost $4.71 per ton.
1905—Milled 75,000 tons of Osceola amygdaloid, yielding 22 lb. per ton.
1906—Milled in March 27,018 tons of Osceola amygdaloid.
1906—Milled 1,900,000 tons for 87,305,000 lb., or 45.9 lb. per ton.
1907—Milled 1,900,000 tons of Calumet conglomerate.
Also 320,000 tons Osceola amygdaloid for 6,892,518 lb.
Making 2,220,000 tons altogether for 92,584,000 lb., or 41.7 lb. per ton.
Total cost this year 8½ cents per lb. Value, 22½ cents. Profit, $13,120,000.

Memorandum of scheme for building up surplus: Money is being put into land and mining companies such as Osceola, Centennial, Allouez, etc., containing Kearsarge and Osceola lodes. These investments ought to yield 10% per annum. Beginning now with $9,000,000 invested the company can add $1,000,000 per annum from earnings of the present mine and let dividends accumulate. There will be in

1908	$9,000,000	+ $1,000,000	: interest	$10,900,000
1909	10,900,000	+ 1,000,000	"	12,990,009
1910	13,000,000	1,000,000	"	15,300,000
1911	15,300,000	1,000,000	"	17,850,000
1912	17,800,000	+ 1,000,000	"	20,600,000

1913 20,600,000, and so forth.

It is apparent, therefore, that in 1917 the company will have accumulated $10,000,000 surplus, yielding an income of $1,000,000 per annum. This is entirely feasible and probable, because by mining 3,500,000 tons of Kearsarge lode the output can be raised to 80,000,000 lb. at 10 cents per lb. The Calumet & Hecla has now 11,000 ft. on the Osceola lode, and 12,400 ft. on the Kearsarge lode opened up. If one-half of this ground can be mined to a depth of 3000 ft., it should produce at least 50,000,000 tons containing over 500,000 tons of copper at a profit of $100 per ton, or $50,000,000. The company controls the Allouez, Centennial, Osceola, and other mines, giving 10 miles more on these lodes, which should produce $125,000,000 more in profits if one-half can be mined.

ANACONDA.—This company has produced and earned as follows:

Year.	Copper. Tons.	Silver. Oz.	Gold. Oz.	Total value.	Cost per ton.	Earnings.
1896.....	52,518	5,308,000	18,300	.....	$9.43	$1,000,000
1897.....	66,182	5,935,837	20,380	.....	9.17	4,969,408
1898.....	62,209	5,074,036	18,000	$17 582,000	9.30	4,000,000
1899.....	53,907	3,750,000	14,000	18,400,000	9.50	6,000,000
1900.....	55,000	3,750,000	14,000	21,300,000	10.00	7,300,000
1901.....	50,925	3,600,000	14,000	19,200,000	10.00	5,300,000
1902.....	38,000	2,650,000	12,000	.....	.....	1,680,000
1903.....	46,750	3,200,000	20,000	.....	.....	2,000,000
1904 (18 mo.)....	60,900	4,000,000	22,000	18,800,000	8.50	4,350,000
1905.....	47,722	3,116,880	19,165	....	7.78	5,718,000
1906.....	47,482	2,979,908	15,984	.....	8.23	8,842,000
Total.....	582,595	43,364,000	188,000	.....	.....	$54,159,000

The earnings have gone as follows:

Dividends.....$33,000,000
Bonds paid off 3.600,000
Surplus..... 17,500,000 in cash and supplies.

Total.....$54,100,000

In this period of 12 years copper has averaged 14.1 cents per lb., silver 60c. per oz., and gold $20.67 per ounce. The value of the product therefore has been:

Copper.....$164,490,000 = 84.5% of total
Silver ..... 26,000,000 = 13.5% " "
Gold ..... 3,900,000 = 2.0% " "

Total.....$194,390.000 Profits, 28%

The mine has been able to produce copper at 10.17c. per lb., silver at 43.3c. per oz., and gold at $14.91 per ounce.

In 1906 copper accounted for 90% of the value; silver, 8½%, and gold, 1½%. On this basis copper cost 11.8c. per lb., silver 35c., and gold $13.50 per ounce. This rise in the cost of copper has taken place in spite of a decrease in the cost per ton of production from $9.43 in 1896 to $8.23 in 1906. It is caused by a diminution of the value of the ore on average prices as follows:

1895-6. Value, $15.93. Cost, $9.30. Margin, $6.63..... { Copper ....14.1c. Silver .....60.0c.
1905-6. " 10.54. " 8.01. " 2.53..... { Gold $20.67

It appears, therefore, that the continuance of this process of diminishing value will in six years more extinguish the margin of profit. On this basis the dividends to be expected from the property would be as follows:

Surplus.....$18,000,000
Earnings.. 12,500,000

Total $30,500,000
Less ..... 5,700.000 already paid.

Total $24,800,000

} At average prices.

I believe that better results can be obtained by diminishing the tonnage and maintaining the grade as it stands at present. By diminishing the tonnage by 5% each year the mine can last 20 years, and produce 13,200,000 tons at a profit of $33,000,000; add surplus (less dividends paid), $12,300,000; making a total of $45,300,000.

Discounting this until it is paid would give a present value of $30,000,000. This is the best that can be expected.

BOLIVIA has long been favorably known as a source of supply of bismuth, the metal occurring with tin, gold, and silver ores, especially at Tasna and Chorolque. In France bismuth has been discovered in quantity with wolfram, pyrite, and phosphatic minerals. The Cornwall, England, tin and copper mines produce it in small quantity.

The Great Gold Mines—II.

Written for the MINING AND SCIENTIFIC PRESS
By T. A. RICKARD.

(*Continued From Page 13.*)

Outside of the five mining districts mentioned in the preceding paragraphs, there are a number of localities made famous and important by the production of individual mines. These include four of the biggest: the Waihi, the Mt. Morgan, the Homestake, and the Goldfield Consolidated.

The Waihi, the great gold mine of New Zealand, is in the Hauraki district of the North Island. During the calendar year 1906 this mine produced 328,866 tons, yielding 168,012 oz. gold and 1,133,062 oz. silver, together worth $4,001,250, or $12.23 per ton. The profit for the year was $2,435,056, from which dividends and bonus were paid amounting to $1,926,633. From its inception (in 1893) to 1906 this mine had produced £5,355,254 from 1,921,670 tons of ore, and £2,296,548 had been distributed in dividends, besides the £146,160 paid in the form of income tax, the last being a direct saving to the shareholders. The reserves are estimated at 1,029,658 tons, or a supply for three years ahead. The main lode, called the Martha, averages 90 ft. in width for a length of 1400 ft. and has been developed to a depth of 800 ft. It is only one of a series of interlacing veins. The mine is wet; two Cornish pumps raise about 700,000,000 gal. per annum. At the end of 1906 the main shaft was only 856 ft. deep; it is now just below the 1000-ft. mark.

The Mount Morgan is the greatest gold mine of modern days; it has yielded (up to May 31, 1907) no less than 3,079,695 oz., worth $60,961,087, out of which $32,757,705 has been paid in dividends. As the company was organized in 1886, this record covers twenty-one years. During the last fiscal year the total revenue was $1,531,991, of which $1,663,725 was profit. Originally a high-grade gold mine, Mt. Morgan has proved to be an immense gold-bearing gossan capping a mass of gold-bearing copper pyrite. In the year ending on May 31, 1907, the extraction of oxidized ore from the big open-cut gave 120,373 tons, yielding 35,313 oz. gold or an average of 5.86 dwt. per ton. Since the inception of the company 2,049,532 tons of oxidized ore has been extracted. It has been worked to a depth of 315 ft., at which level the sulphide ore makes its appearance. Of sulphide ore, 115,166 tons were mined during the year, the yield being 61,370 oz., or an average of 10.6 dwt. per ton. From this ore, 361 tons of copper were extracted. The total yield included 97,923 oz. gold and 361 tons of copper precipitate from the chlorination works, besides 3723 tons of copper and 47,215 oz. gold by smelting, that is, a grand total of 145,139 oz. gold and 4087 tons of copper, giving Mt. Morgan high rank as a producer of either one or both of the metals. Of the 600,732 tons of material removed during the year, 265,779 tons were rejected as waste and 334,953 tons went to the reduction works. The average, therefore, was 8.7 dwt. gold and 1.22% copper. The deepest level is at 850 ft. The reserves are estimated at about 2,500,000 tons, from which a profit of $12,500,000 should be made.

The Homestake mine was crippled in 1907 by a fire that broke out above the 600-ft. level on March 25. In order to extinguish the fire, it became necessary to flood the mine, and stop production. It was not until July that all the stamps were dropping again. Hence the record of production in the last fiscal year does not do justice to this great mining enterprise. Moreover, $305,421 was expended on the new slime plant, for this company follows the sensible custom of debiting all cost of equipment to revenue account. The new slime plant is a great success and has nearly doubled the operating profit. At the present time the Homestake is yielding $500,000 per month, of which $200,000 is profit, so the figures for the current year will be highly satisfactory.

PRINCIPAL MINES IN AMERICA AND ASIA.

Name of mine.	Region.	Per annum.			Per ton.			Year ending.
		Tons.	Yield.	Profit.	Yield.	Cost.	Profit.	
America.			$	$	$	$		
Camp Bird	Colorado	38,295	1,311,514	925,312	35.03	7.69	27.34	April 30, 1907.
Tomboy	"	110,597	1,295,123	778,735	12.30	4.67	6.92	June 30, 1907.
Portland	"	92,265	1,817,256	512,106	19.89	14.14	5.55	Dec. 31, 1906.
Stratton's Independence	"	75,280	1,245,121	310,965	16.51	12.03	4.51	June 30, 1906.
Goldfield Consolidated	Nevada	31,338	6,296,476	3,760,358*	200.92	80.93	119.99	Oct. 31, 1907.
North Star	California	81,672	856,326	311,059	9.75	6.08	3.67	Dec. 31, 1906.
Homestake	South Dakota	1,264,177	4,845,011	1,223,836	3.83	2.86	0.97	May 31, 1907.
Alaska-Treadwell	Alaska	702,953	1,511,671	571,706	2.15	1.31	0.81	May 31, 1907.
Mexico and Central America.								
Dos Estrellas	Mexico	214,744	2,971,157	970,800	13 81	9.32	4.52	Dec. 31, 1906.
El Oro	"	280,304	2,243,168	951,330	8.61	4.95	3.66	June 30, 1907.
Esperanza	"	228,419	7,708,883	1,641,279	33.71	13.41	20.33	Dec. 31, 1906.
Butters Salvador	Salvador	21,348	1,043,128	728,979	48.86	14.71	34.15	June 30, 1907.
Asia.								
Oriental Consolidated	Korea	231,827	1,232,283	361,696	3.90	2.48	1.42	June 30, 1907.
Mysore	India	185,900	3,925,652	2,231,068	21.11	9.11	12.00	Dec. 31, 1906.
Oregum	"	122,537	816,483	368,246	6.90	3.89	3 01	Dec. 31, 1906.
Champion Reef	"	203,174	3,291,721	1,685,903	16.20	7.91	8.29	Sept. 30, 1906.
Nundydroog	"	81,750	1,321,062	553,870	16.15	9.38	6.77	Dec. 31, 1906.
Balaghat	"	53,750	867,660	379,140	16.12	9 07	7.05	Dec. 31, 1906.

*Estimated. See detailed description.

Nevada is producing gold at a great rate, but the methods of operation do not lend themselves readily to the detailed tabulation of results. Owing to the State tax on profits, the companies are chary of publicity. Moreover, between the stock-jobbing schemes of those in control and the ore-stealing activities of those whom they employ, the statistician is driven to despair, for no trustworthy data are available. However, the consolidation of mines at Goldfield, under the name of the Goldfield Consolidated Mines Co., has published its annual report recently, and amid a maze of jumbled accounts there is enough information to prove that this property in Nevada was the most productive gold mine in the world in 1907. The total output for the fiscal year ending on October 30, 1907, was 31,338 tons, having a gross value of $6,296,476, or the magnificent average of $200, that is, about 10 oz. gold per ton. The total profit to the company was only $1,760,358, or 26% of the gross output, but to the company's profit must be added that of the lessees, estimated at $2,000,000, so that the mine is credited with a total profit of $3,760,358. Furthermore, fully $1,000,000 worth of ore was stolen, on which the thieves made not more than 10% profit, the rest being divided among the middlemen and ore-buyers; but this item cannot be credited to the mine. It is clean loss, the penalty of excessive richness

and a labor situation without parallel. This wonderful mine has yielded fully $15,250,000 in the four years since the discovery of ore in November, 1903, although the bulk of the output has been made since April, 1906, when the Mohawk bonanza was uncovered. Up to date the following is the estimated yield of the component mines:

Mohawk	$ 9,850,000
Jumbo	1,625,000
Red Top	500,000
Combination	3,000,000
January	275,000
Total	$15,250,000

Of this total, about $7,000,000 has been profit to the company and the lessees. The last shipment (one carload) of ore made from the Hayes-Monnette lease (in January 1907) weighed 48 tons, averaging $12,230 per ton or $6 per pound of ore. The check from the Selby Smelting & Lead Co. amounted to $574,958 and the express charges (that is, transport and insurance) were $8810 for the carload. The ore was in sacks weighing 632 lb. apiece. Up to the date of consolidation (in November 1906), the Mohawk shipped 34,797 tons having a gross value of $4,075,919, on which the royalty paid to the owners of the mine was $705,469. The orebody was discovered in April 1906 and prolific production started in August, not less than $5,000,000 worth of ore being extracted (though not all of it was shipped) in 106 days.

The consolidated mines are now under experienced management and future reports are likely to be more luminous and less voluminous. As to ore reserves, no accurate information is available. In the prospectus, issued on November 21, 1906, the "future production" is estimated as "at least $30,000,000", while in the report for October 31, 1907, the ore developed is stated to amount to 1,000,000 tons, averaging $25 per ton, of which $17 "should be profit." As the bottom workings at 500 ft. are in rich ore, the future of this mine looks brilliant. Profits will be increased when the mill is built; this will contain 100 stamps and treat 500 tons per day at an estimated cost of about $2 per ton. Up to the present the Goldfield Consolidated has been a gold mine to the smelters, the railroads, and the ore thieves, henceforth it should prove a treasury to its owners.

While Cripple Creek is still the chief goldfield in Colorado, the leading mines are in the southwestern portions of the State, between the towns of Ouray and Telluride. The Camp Bird is the most productive and next to it comes the Tomboy. The Tomboy Gold Mines is a company controlled by the Exploration Co. of London. It affords a good example of an enterprise that started with one mine which proved disappointing, and then acquired a neighboring property, which exceeded expectations. The old Tomboy mine was a fizzle, but the Argentine, which was bought as a prospect and developed into a large mine, has proved a winner. In the year ending on June 30, 1907, the output was 110,597 tons, yielding $1,295,123, of which $778,735 was profit, permitting the payment of $545,625 in dividends. The ore reserves are estimated at 408,000 tons and the development has reached a depth of 2100 ft. below the outcrop.

Owing to the snowslide and fire that destroyed the mill of the Camp Bird company in March 1906, the production for that year was interrupted. The new 60-stamp mill was rebuilt without loss of time at an expense of $177,807. As the fiscal year of this company ended on April 30, 1907, the record covers the operation of the mill during 181 days, beginning on November 1, 1906. During that time 38,295 tons were treated, yielding $1,339,864, of which $44,198 was silver and $22,114 lead and the remainder gold. In order to redress the loss due to the destruction of the mill and the period of inactivity, the policy adopted was to extract the higher grade ore already lying broken in the stopes. Of this class of ore 25,809 tons were sent to the mill, and 13,731 of freshly broken ore. On April 30, 1907, there were 112,000 tons of broken ore in the stopes and chutes, and 89,000 tons blocked out, making a total of 201,000 tons, estimated to yield a profit of $3,500,000. In the last five years the Camp Bird has yielded $9,494,635, of which $6,324,270 has been profit. The dividends represent 95% on the capital of the company. But the future of this splendid mine does not promise a continuance of its present prosperity, for exploratory work in depth has led to the discovery only of irregular patches of pay-ore, the best results during the last three or four years being in the workings above the upper adit.

The Alaska-Treadwell, on Douglas Island, Alaska, has been crippled during the past year by lack of fuel. The figures in the tabulated statement are for the year ending May 31, 1907, but they are not a fair average. During the previous year the output was 888,411 tons, yielding $1,902,455, of which $925,193 was profit. The yield per ton was $2.141; of this $1.074 was free gold obtained by amalgamation and $1.067 was extracted from concentrate by chlorination. Up to May 31, 1907, the total yield of the mine was 8,485,085 tons, yielding $20,735,788, of which $9,861,439 was profit. The yield has included $12,524,507 from free gold and $8,211,281 from concentrate. The ore reserves are estimated at 5,000,000 tons.

The principal gold mine in Utah is the Mercur, which has paid dividends of $1,205,000 since the consolidation of the old Mercur and De La Mar companies in 1900, and $3,385,313 altogether. For the year ending on June 30, 1907, the production was 245,169 tons, yielding $642,844, from which no profit was earned.

The North Star mine at Grass Valley is the basis for one of the most satisfactory mining enterprises ever started in California, and it has been a highly profitable mine to various owners during the past 57 years. From 1850 to 1884 the North Star produced $2,500,000. The present undertaking, under the direction of James D. Hague, is an example of a well managed and highly successful mining company. From May, 1884, to the end of 1906, the total production has been 487,763 tons, yielding $7,477,940, or an average of $15.33 per ton, from which the operating profit has been $2,928,473, permitting dividends to be paid to the amount of $1,286,988. In the year ending on December 31, 1906, the North Star Mines Co. treated 84,672 tons of ore, yielding $826,326, with a profit of $311,059. For 1907 it is estimated that the output was 80,000 tons, yielding $925,000, from which dividends amounting to $250,000 will be paid, as was the case last year. The deepest workings are at 4700 ft. on the dip of the vein.

Data relating to California mines are difficult to obtain owing to a policy of secrecy, due in part to labor troubles and in part to the influence of the stock market. The North Star Mines Co. is a pleasant exception, as the preceding paragraph indicates. Having a first-rate management and a profitable enterprise, the relations of the company are as harmonious with the employees as they are with the shareholders. Another important mine that is doing well is the Kennedy, at Jackson, on the Mother Lode, but, while knowing the output and profit made during 1907, we are requested to withhold the information. The most profitable gold mines in California are the Yuba Consolidated, at Marysville, and the Oroville Dredging, at Oroville. Oroville Dredging Ltd., a London company, produced $705,839 for the year ending July 31, 1906, and of this amount $355,705 was profit; in the six months following (that is, up to January 31, 1907) the yield was $473,108 and the profit

The Destruction of the Camp Bird Mill in March, 1906.

The Esperanza Mine, El Oro, Mexico.

$267,000. Later figures are not obtainable, but they are at least as good. Concerning Yuba Consolidated, we can only say that the output was $1,500,000 and the profit in excess of $1,000,000 for the calendar year 1907. This is the only gold mine in California yielding either $1,000,000 profit or $1,000,000 gross during 1907 and it promises to be a magnificent enterprise. The two leading gold mines of California are dredging undertakings, and this fact emphasizes the relative importance of this branch of mining.

The Oriental Consolidated, in the Wunsan district of Korea, is an important gold mine, for up to June, 1907, it had produced 1,337,519 tons of ore containing $9,116,227. During the last year or two the profits have been less, but the new cyanide mills and the healthy development of the mines give promise of better results in the present fiscal period. In the year ending on June 30, 1907, this mine produced 231,827 tons, containing gold worth $1,232,263 and made an operating profit of $364,696. The value per ton was $5.31, the extraction $3.90, the costs were $2.48, and the profits $1.42, the last being decreased by construction expenses and development of outside mines to 90 cents per ton. This mine is held under a concession granted to a group of New York financiers, and it is under the experienced general management of H. C. Perkins.

Butters Salvador, in the State mentioned in the last part of the name and under the direction of the energetic metallurgist indicated by the first part, is the most productive gold mine in Central America. Up to July 1, 1907, the output has been 80,962 tons, yielding $3,808,826. The ore reserves are estimated at 62,963 tons, containing $4,087,000. The maximum depth of the workings is 628 ft. The ore contains copper and this makes the cyanidation difficult. After being roasted, the ore is crushed in Krupp ball-mills and then cyanided. The consumption of cyanide is 8 to 10 lb. per ton of ore. Copper is saved at the rate of 1½ tons per month.

In Brazil, the St. John del Rey is a grand old mine that has been worked by the same company since 1834. A fire and the caving of the big stopes have crippled production during recent years. The incline shaft is over a mile long and the vertical depth is 4000 ft. During the half-year ending on August 31, 1907, this mine produced 76,690 tons, yielding $787,271, of which $181,948 was profit.

The leading gold mine of New South Wales and the only one of the first rank is the Mt. Boppy, in the Cobar district and near celebrated copper deposits. In 1906 the output was 72,976 tons, yielding $617,218, of which $306,167 was profit. Down to 400 ft. this mine has now produced $2,215,670, from which $993,315 has been distributed in dividends.

Two mines in West Africa are worthy of mention. In the year ending on June 30, 1907, the Abosso produced 36,881 tons, yielding $542,475, of which $214,956 was profit. The reserves amount to 187,831 tons, the average assay being 17.25 dwt. per ton. The Ashanti Goldfields during the same period produced 48,610 tons, yielding $914,361, of which $394,906 was profit. This company is to be reorganized. The bottom of the mine (at the 6th level) is poor and the outlook is bad.

In the Transvaal there are no big mines outside of the Rand district, unless it be the Sheba, at Barberton, which was a rich mine before the war. Up to 1907, the Sheba had produced 872,341 tons, yielding 638,975 oz. or about $12,500,000. For the year ending on June 30, the output was 66,250 tons, yielding gold worth $677,220. The Sheba paid over $3,500,000 in dividends in the days of its prosperity.

In point of magnitude of operations, the Homestake is first, for it keeps 1000 stamps busy, crushing 4000 tons per day. Next comes the Alaska-Treadwell with 540 stamps, in two mill-buildings containing 240 and 300 stamps respectively, and crushing altogether 2840 tons per day. The loss of quicksilver is given as 32.47% in one mill and 35.19% in the other. In South Africa the biggest milling plant is that of the Simmer & Jack, with 360 stamps, of which 320 are in use, the crushing capacity being 2070 tons per day. The Robinson has 300 stamps, and 13 other companies on the Rand have mills of 200 stamps or more. The Waihi has 330 stamps, the average number at work being 317, with an average duty of 3.5 per stamp or 1110 tons per diem. The work of reduction is aided by 5 tube-mills, and it should be added that in South Africa also tube-mills are steadily raising the duty of the stamps.

BRIQUETTING PLANT IN ARIZONA.—A briquetting plant was put in operation in September, 1905, by the Arizona Copper Co., Ltd., at Clifton, Ariz. It was installed for the purpose of utilizing coke-breeze, for securing greater efficiency from the Gallup slack coal, and for obtaining a fuel that would not materially deteriorate under storage. In the briquetting of the coke-fine a profit of about $4 per ton is made in the conversion of a formerly wasted material into good fuel. Briquetting the Gallup slack coal was not advantageous economically, because the expense brought the cost about the same as that of the lump coal obtained from the same source. The real profit in briquetting this coal is in the superiority of the product for stocking purposes, as it stands weathering perfectly and is not liable to spontaneous combustion. In the making of the briquettes 92% of the coal is mixed with 8% of California asphaltic pitch and compressed. The briquettes are rectangular in shape and weigh about 4 lb. each. The capacity of the plant is 25 tons per 10 hours. About 300 tons were produced in the experimental runs made in 1905. During the first six months of 1906, the plant produced 690 short tons of a total value of $1830, or an average of $7 per ton. This included briquettes made from coke-breeze. The coal briquettes have been found to burn freely and satisfactorily under locomotive and stationary boilers.

COPPER IN THE PHILIPPINE ISLANDS.—The best-known occurrence of copper in the Philippine Islands is in the Mancayan-Suyoc mineral region of the province of Lepanto. Sulphide ores predominate and were extensively worked in 1850 and later. Between 1864 and 1874, a Spanish-Filipino company produced 1100 metric tons of copper in the vicinity of Mancayan. An American syndicate is now developing a number of new claims. In the Suyoc district several copper deposits are being developed. The ores consist of auriferous tetrahedrite, tennanite, enargite, and luzonite; the Government samples showed, by assay, 9.7 to 39.9% copper and 85c. to $4.75 gold per ton. Veins of refractory gold-copper ore occur in the Buld River district. In the foothills of the northern Zambales range, near Salasa, copper veins rich in gold are being developed. The Bataugas province contains copper in the Loboo mountains. The veins are of two systems and are in dioritic rock. They are 6 in. to 2 ft. wide and carry bornite, chalcopyrite, tenorite, cuprite, chalcocite, malachite, and azurite; also, some gold and silver. The gangue is quartz. However, copper has not yet attracted the attention which has hitherto been given to coal and gold in the islands.

ONLY two per cent of people are left-handed. Right-handedness is due to the localization of the cerebral centre of the intellect in the left-half brain.

National Mining Bureau.

In our issue of January 18 we published the text of a bill before the Congress of the United States, the purpose of which is to create a Mining Bureau under the Department of the Interior. The subject is of great interest to all those engaged in mining, directly or indirectly, so we need not apologize for giving herewith a copy of the letter addressed by Mr. George Otis Smith, Director of the Geological Survey, to the Secretary of the Interior. For the letter we are indebted to the Director himself, who judged rightly that we would be glad to have the opportunity of affording our readers a chance to listen to his argument in behalf of the Survey. Our own views need not be re-iterated on this occasion; they will be found in the MINING AND SCIENTIFIC PRESS of January 18, December 7, and November 29. The Director's letter begins by acknowledging the Secretary's request for "an expression of opinion relative to the desirability of a more extensive recognition of the mining industry by Government investigations." Thereupon the Director of the Survey says:

The beginnings of Federal investigation of mineral resources are to be traced back to the early part of the last century, when Lewis and Clark were instructed to pay special attention to the geology and mineral resources during their exploration work. The explorations and surveys that were continued during the first half of the nineteenth century were a further recognition of the duty the Federal Government owed the people in making known the resources of the great unexplored western half of the continent. These explorations were particularly actively pushed after the discovery of gold had focussed public attention on the mineral wealth of the trans-Mississippi region. While the results of these various surveys were of inestimable value to the development of the mining interests of the regions that they covered, yet there was lack of coordination and an absence of a comprehensive plan covering the entire field. Moreover, it had not yet been recognized as the province of the Federal Government to investigate the resources of the entire national domain and not simply those of the public lands.

In 1866 a more direct attempt was made to aid the mining industries by an appropriation which authorized the Secretary of the Treasury to "collect reliable statistical information concerning the gold and silver mines of the Western States and Territories." Though this investigation received inadequate financial support, yet the results obtained by Dr. R. W. Raymond were of the utmost value to the mining interests.

When, in 1879, the U. S. Geological Survey was authorized by Congress, all other Federal surveys of a similar character were abolished, and the office of Commissioner of Mineral Statistics under the Treasury Department also lapsed. The organic law provided that the Director of the Geological Survey "shall have the direction of the Geological Survey and the classification of public lands and examination of the geological structure, mineral resources, and products of the national domain." It is to be noted that this authorization, besides providing for geologic investigation also directly authorizes the study of mineral resources and *products* of the national domain. It would appear therefore that Congress believed it was providing for all phases of work properly belonging to a mining bureau. In any event, the first Director, Clarence King, regarded the law as a justification for him to undertake investigations of not only a geologic character, including examinations of orebodies, but also the study of mining and metallurgical methods. This fact is clearly shown in the summary of his first report, wherein he provides for the following publications, based on investigations inaugurated by him:

Geology and Mining Industry of Leadville, Colorado.

Geology of the Eureka Mining District.

The Copper Rocks of Lake Superior.

History of the Comstock Mine.

The Comstock Lode.

Mechanical Appliances Used in Mining and Milling on the Comstock Lode.

Coal of the United States.

Iron in the United States.

The Precious Metals.

Lesser Metals and General Mineral Resources.

The Uinkatet Plateau.

Lake Bonneville.

Dinocerata.

Out of these 13 publications it will be noted that 10 were to be devoted to the subjects of applied geology and technology, and it is evident, therefore, that King regarded the U. S. Geological Survey as being charged with the duty of directly serving the mining industry of the country. Unfortunately, the broad plan of investigation which King had outlined could not be carried out because of the inadequacy of the funds provided for the work. It appears that King's successor, Major Powell, on this account established as his policy the plan of carrying on the fundamental geologic work which he knew was absolutely essential as a preliminary to the solving of the problems connected with economic geology. Major Powell's success, therefore, as an administrator of scientific work was due to the fact that he laid the plans on broad scientific lines. He also organized a Division of Statistics and Technology, but, unfortunately again, this work received so little support that not much original investigation could be carried on.

In 1894, when Mr. Walcott took the leadership of the Geological Survey, he was quick to realize that the time had come when more attention should be given to the immediate wants of mining interests. His plan, therefore, involved investigation of nearly every phase of the mineral resources of the country, though at the same time he did not curtail the study of the larger geologic problems. Probably the most important feature of Mr. Walcott's administration from the standpoint of mining was improvement in methods of collection of statistical data, and by his advice this work was extended to include that of

the precious metals. Mr. Walcott went back to Clarence King's original plan of placing the supervision of the collection of mineral statistics in the hands of the expert economic geologists, as being the only men who could have a comprehension of the resources to be considered. As a result, the statistical work of the Survey is on the highest plane and is frequently quoted in this country and abroad as an example of what all other countries should inaugurate. Under Mr. Walcott, too, technologic investigations were inaugurated; but these were limited by the appropriations to definite fields.

Under both Powell and Walcott the development of topographic mapping of mining districts was actively pushed. This phase of the Survey work, like the investigations of geologic problems, is of fundamental importance to all economic work.

To summarize briefly the items in the work of the Geological Survey which bear directly on the mining industry:

1. Annual reports showing the mineral production of the various mining districts and the various mineral products and also those that summarize the mining development throughout the country. These reports have the most direct bearing on mining, but they could only be prepared because of the extensive investigations which had preceded them during the existence of the Survey.

2. Monographic treatises on particular mining districts or particular kinds of mineral deposits.

3. Geologic maps, which must form the basis of the study of the distribution of mineral products. An area of 138,536 square miles is already covered by these maps.

4. Reports on water resources, many of which pertain to power available for mining.

5. Topographic base maps for the use of mine operators, mining engineers, and prospectors, as well as for the use in the study of geology.

6. Technologic studies of mineral products. This so far has been practically limited to the investigation of the utilization of the mineral fuels and building material.

The Survey investigations relating to mining have all been approached from the standpoint of the scientist, a policy believed to be in accord with the spirit of the Congressional enactment establishing this branch of the public service. The present importance of economic or applied geology is to a large extent the result of the Survey's activity and the practical value of its contributions has won world-wide recognition. In the present organization of the Survey, two divisions of the Geologic Branch and one of the Technologic Branch are devoted exclusively to the mining industry, while a large part of the work of the Technologic Branch and of the Division of Geology and Paleontology and of Chemical and Physical Research in the Geologic Branch contribute directly to the aid of the mining industry of the country, not to mention the indirect but important service rendered by the Water Resources Branch and the Structural Materials Division of the Technologic Branch. It is worthy of notice that the Divisions of Mining and Mineral Resources and of Alaskan Mineral Resources are at present keeping in close touch with the mining industry. Through their work, the Survey is in possession of complete lists of the mines of the United States and also nearly complete lists of Alaskan mines and from these mines the division receives statements of annual production. On this basis summaries of the state of the mining industry at the close of each year are prepared and published. The importance of this statistical work has been clearly stated by Dr. R. W. Raymond, formerly Commissioner of Mineral Statistics, and an eminent authority among mining engineers, who, moreover, has recognized the Survey as the successor to the investigations and publications inaugurated by him.

The Geologic and Water Resources Branches have for several years been conducting a joint investigation of the débris problem, which had never before been adequately considered on a scientific basis. The technologic work relating to mineral fuels has been authorized by appropriation items, yet this work undertaken under Director Walcott differed little in scope from investigations planned by Director King, but necessarily for a long time neglected in the absence of any specific appropriation by Congress.

While it might be held that the organic authority granted the Director to examine the geologic structure, mineral resources and products of the national domain is sufficient for any extension of the mining work, yet in view of the present well warranted demand for expansion of such mining work, it seems advisable to secure from Congress specific authorization for these investigations. However, before considering the best means of providing for the new work in aid of the mining industry it is necessary to mention the lines along which extension of Federal work is requested. Especially is this important since there does not appear to be any consensus of opinion as to exactly what should be the scope of a new bureau or what shall be its relations to the existing organization. In fact, some of those who have advocated further recognition of the mining interests have been unfamiliar with the work of the Geological Survey and have not realized how closely its activities were related to the mining field. First among the kinds of mining work for which there has for many years been a steadily increasing demand is the study of ore and mineral deposits. The work of the Geological Survey in the interests of the prospector and mining engineer has been appreciated throughout the mining communities. Two only of many cases of official recognition of the value of the Survey's work need be cited in this connection. The Legislature of Pennsylvania, the State which stands first in the value of its mineral products, provides for co-operation in geologic work with the Federal survey, entrusting to the latter the expenditure of State money in the investigation and mapping of its mineral resources. The General Assembly of the State of Colorado has twice, at least, expressed its appreciation of the Geological Survey. In 1879 in a memorial to Congress, presented by Senator Wolcott, this Assembly petitioned Congress "to make

generous provision for that branch of the United States Geological Survey which is engaged directly in examining metalliferous districts of the States and Territories'' and urged speedy publication of the results.

Ten years ago the statistics of mineral production collected by the Geological Survey were regarded as incomplete in that those of gold and silver were not included, and a public demand was made for the inclusion of these statistics in the annual report of the mineral resources of the country. At present the collection of these has been authorized by Congress. The Survey's policy that the mining industry of the country is stimulated and guided by the distribution on the part of the Government of statistical and technical information has commended itself to the mining public generally and it has been well said that the distribution of knowledge is the one governmental activity which carries the largest probability of general benefit. Many authorities have emphasized the necessity of entrusting its statistical work to geologists, who not only can properly classify each year's production but can measure the amount of the nation's reserve of mineral wealth.

There is another field in which the demand is actuated by real needs and this includes investigation into the methods of mining and metallurgy, especially with reference to the prevention of accidents and the better utilization of mineral products. Investigations already made along these lines by the Geological Survey show that this work lies well within the province of the Federal Government. Yet a large part of the field is as yet unoccupied and would include reports on the newest development in the various branches of the art and short summaries of mining and metallurgical methods for the use of prospectors and operators.

Many advocates for a Department or Bureau of Mines mention the need of Federal inspection of mines. The inspection of mines except in the Territories and the district of Alaska belongs essentially to the police regulations of the State authorities, so that in the absence of any Federal law regulating the operations of mines there is no field for a system of mine inspection, regulation, and supervision, except within the territories where this is already performed by inspectors who report to the Geological Survey. However, the publication of the results of investigations on this subject of mining methods and the nature of explosions in their relation to gas and dust in coal mines, the character of explosives, and other subjects affecting the safety of mine employees and of mining property constitute a duty which the Federal Government might, and should, assume through a scientific bureau.

The investigations of labor conditions in the mining industry and of the capitalization of mining corporations are functions delegated to mining bureaus in some foreign countries; but these are subjects that in the United States plainly belong to the appropriate bureaus of the Department of Commerce and Labor.

The expressed desire for free assays and analyses and for examinations of private mining property is complimentary to the character of the work performed by the various scientific bureaus of the Federal Government; but, in my opinion, this demand is for private and not public work and can more properly be met by the private assayor and mining engineer as well as by the State mining bureaus and schools of mines, leaving for investigation by the Federal Government only the larger inter-state and Federal problems that are basal in character and important in the whole mineral industry. The investigations already carried on by the Geological Survey are of this type.

To recapitulate: Of these functions mentioned by advocates of extension of Federal activity, two, namely, the study of mineral deposits and the collection of production statistics have been performed by the Geological Survey since its organization and the extent of such work has been limited only by the amount of public money appropriated; two others, namely, the investigation of mining technology and the supervision of Federal mine inspection in the Territories are now definitely provided for in the Survey organization—the scope of technologic work being as broad as is authorized by the terms of the appropriation; and of the remaining two, the investigation of labor and corporation conditions belongs to another Department, while the work of assays and examination of private mining property is more properly the privilege of men in professional practice or of a State bureau than it is the duty of a Federal bureau.

To meet the actual needs of the industry, the time is opportune for the enactment of well considered legislation and I submit herewith the draft of a resolution which in the opinion of myself and associates in the Survey is adapted to accomplish the desired end. My purpose is to suggest legislation that will adequately provide for an increase in the mining work by the Federal Government without duplicating that already authorized. Some plans already presented for a Bureau of Mines have contemplated taking over much or nearly all the work of the Geological Survey; others have confined the proposed Mining Bureau's activities to the more purely technologic problems together with the statistical work.

It appears to me that there is only one true line of cleavage between these subjects, and this lies between the pure technology and those matters relating to distribution, occurrence, origin, and production of mineral deposits. Those who advocate the turning over to another organization the statistical work of the Survey have little comprehension of the true character of these investigations. As now carried on, this work embraces not only the tabulating of the statistical information, but also the discussion of the source of the materials themselves.

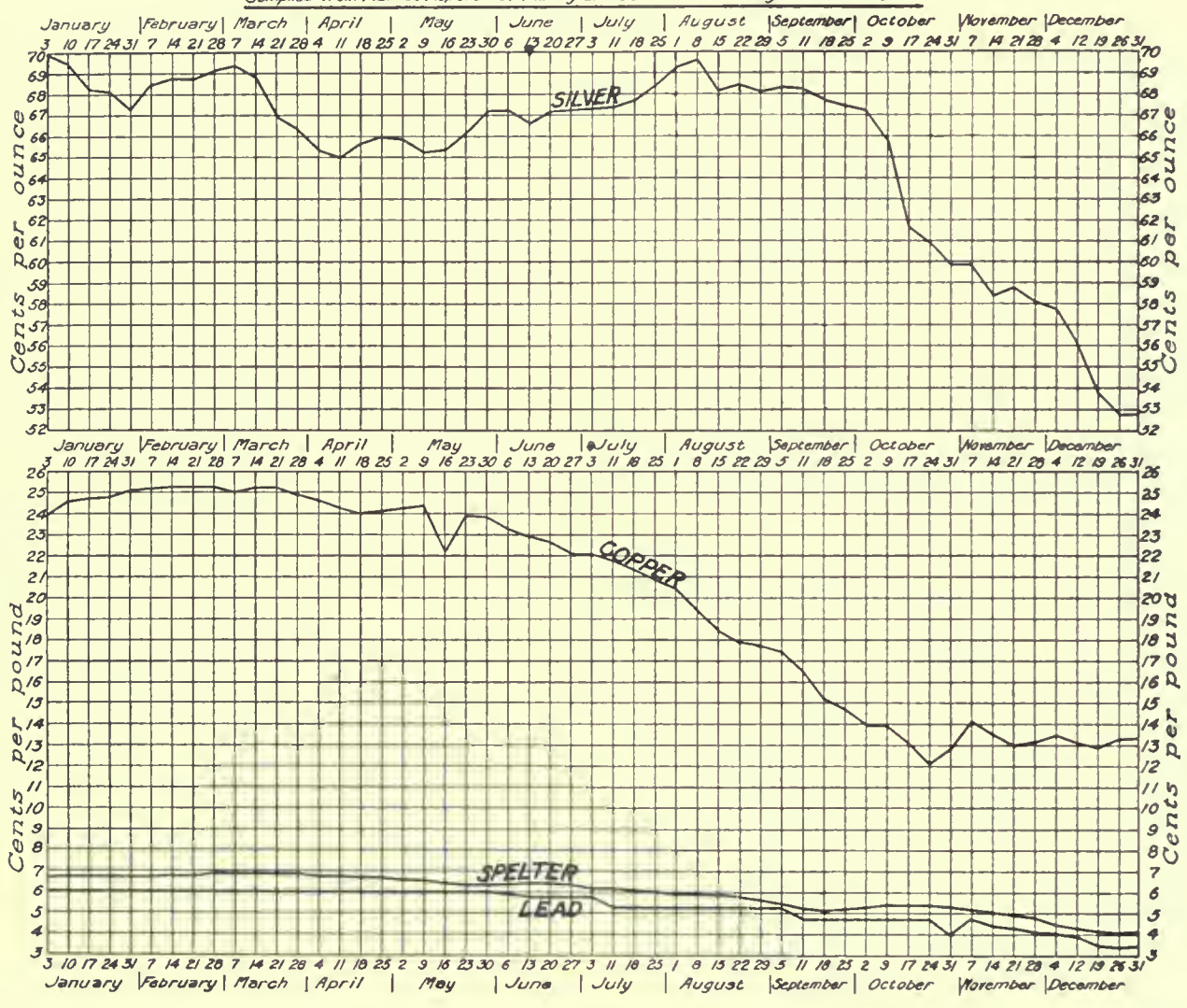
On the basis of the historic development and present status of Federal work in aid of the mining industry of the United States, the limitation of the function of any organization independent of the Survey to strictly technologic work is in my opinion absolutely essential if duplication of work and rivalry are to be avoided.

SELENIUM, one of the rare and little known elements, is closely related in many ways to tellurium and sulphur, with both of which it often occurs in nature. Recently it has obtained some prominence from its use in various forms of electrical apparatus, where advantage is taken of its peculiar property of being almost a non-conductor of electricity in the dark, while under the influence of light its conductivity immediately becomes greatly increased. This characteristic has led to its use in instruments designed for lighting and extinguishing gas buoys automatically; for guiding and exploding torpedoes by a ray of light; for telephoning along a ray of light; for transmitting sounds and photographs or other pictures to a distance by means of a telephone or telegraph wire; and for measuring the quantity of Roentgen rays in therapeutic applications. A general or practical use of any of these instruments would result in an increased demand for selenium. At present the metal is variously quoted at from $13.33 per kilogram (2.2046 lb.) to $2 per oz., as there is no steady market, and the prices vary with different dealers. No selenium is known to be produced commercially in this country, but during 1906 one copper refinery made some in an experimental way, and it is possible that it was produced at other refineries also. At this refinery the selenium was obtained from the anode slimes or mud, where it is left with gold, silver, and other residues in the electrolytic refining of copper. Minerals containing selenium are of rare occurrence in the United States, but a demand for the metal could probably be supplied by utilizing the small quantities found in the copper refinery slimes.

THE HUM OF INDUSTRY.—One has never really heard it until he has stood in the growing hull of a 600-ft. long steel ship and heard a hundred pneumatic riveters at work. Sign language only is used there. Compressed air is the magician. Even the rivet boys are not allowed to lose time pumping bellows at their forges; a tiny stream of compressed air supplies them with forced draught. If a rivet is countersunk, the rough surplus projecting is not slowly smoothed away by man power and hammers and chisels; a pneumatic tool does it in a few seconds. If an emergency requires a rivet hole which has not been punched, a pneumatic drill does the work as deftly as a cook trims a pie crust.—*Gunter's Magazine.*

Graphic representation of average weekly prices of Silver, Copper, Spelter and Lead during 1907

Compiled from Market Reports of Mining and Scientific Press by R. F. Morton, C.E.



GOLD has been found about 25 miles north of Zamboanga, in Mindanao, P. I. It occurs in a sticky yellow clay, which is a weathered portion of schist, but apparently it is found only in very moderate quantity. Its original home was the quartz stringers in the schist. No veins large enough to work have yet been located. The only apparent profitable method of working such placer ground would be by hydraulic means, and as the city of Zamboanga is at present, and probably will for some time to come be dependent upon this river for its water supply, there would undoubtedly be serious objections to this method. Three or four Zamboanga prospectors worked very industriously in this region for over a year sluicing, but apparently did not get a great deal to repay them. For some time to come all thought of accomplishing much in the interior of Zamboanga peninsula will have to be given up, owing to absolute lack of roads.

Drills for Stoping.

Written for the MINING AND SCIENTIFIC PRESS
By ALGERNON DEL MAR.

From observation in California, and particularly in the desert country of the South, where gasoline is readily obtainable at a reasonable cost as compared with other fuel, I venture to say that the application of the small air-hammer stoping drill has not been fully appreciated. I do not mean the hand-drill of the Hardsoeg or Iler type, which is deservedly in favor, but such devices as the Smucker, Waugh, and Sinclair drills, in which the air-pressure keeps the drill up to its work and where the operator is only required to hold or turn the drill. The hand-hammer drills have limitations of usefulness just as the 2¾, 3¼, and 3½-in. reciprocating drills, the former being of use for short water-holes, the latter for hard ground and wide stopes or big headings. Between these extremes comes the class of workings in which the ground is of average hardness, permitting stopes 3 to 6 feet wide, with walls either hard and easily sustained or of a crumbling nature. Under ordinary conditions, whether the walls will stand heavy shooting or not, I believe the small air-hammer drill will outclass a drill of the 2¼-in. reciprocating type in almost any kind of rock and in the case of crumbling walls or walls easily fractured, and therefore requiring excessive timbering, this class of drill will remain as the only kind of economic value outside of hand work, which it will discount in speed about a third and in cost about a half.

A gasoline engine and small compressor capable of running one ordinary 2¼-in. machine will easily run two air-hammer stoping-drills and will break enough ordinary ground to supply a five-stamp mill. I am recommending this type of drill for consideration only as a stoping or raising drill, in other words, for upper holes.

It is often difficult to make comparisons between different machines in a mine, for time is too precious to waste on experimenting, but many conditions arise that compel a change of method. It is one thing to know a certain machine is doing more economical work than another, it is quite a different proposition to represent this difference by an equation, for all the various elements of the equation must be known, and these are not always obtainable. Moreover, actual tests under ideal conditions do not represent the average conditions. For example, the amount of powder used under different conditions, as, where the loading is done under the eyes of an experienced foreman, and where it is done by a crew of ignorant Swedes, gives divers results, both as to the cost of breaking per ton and the state in which the workings are left after shooting. While the foreman will use the necessary powder and only that necessary, the Swedes will fill the hole to the collar whether the hole be made with a ¾-in. steel or a 1¼-in. steel. The answer to this is that the foreman should deal out the powder according to the ground. The Swede answers this by filling up the first holes charged and leaving the lifters with insufficient powder to do the work and the next day the poor showing is imputed to "not enough powder." How does this bear on the subject? Thus: In ground where the walls are easily fractured and liable to cave, a small charge of powder may do the work as well as a big charge and also leave the walls intact. Now the drills I am discussing take ¾-in. grooved steel instead of the 1-in. steel that the 2¼-in. machines take. If we allow a quarter inch for clearance of the last steel used for a hole, the area of the bottom of the hole made with a 2¼-in. machine is over half again as large as that made with the ¾, and if we average a 4-ft. hole, taking into consideration that with the 2¼-in. drill there are at least twice the number of drills needed for a hole, the cubic contents of the holes will be about double. As a general proposition the nearer to the bottom of a hole the charge is, the better the result; but there are cases where the results might by detrimental, so in cases of irresponsible labor and loose walls these drills would take the place of the hand work often applied at a great disadvantage, because the results from shooting holes of larger diameter have been disastrous.

The following test is one extending over four weeks of actual work undertaken under average conditions, not as a test of machines, but one which demonstrated to my entire satisfaction the advisability of a change from the 2¼-in. machines then in use to the drill of the Waugh type, and which did actually discount the drills in use at the time. Another advantage was the fact that the work done by the compressor being limited, the number of places worked could be increased by using less power per machine. In a preliminary canter to test a new machine, with all conditions ideal, we drilled 13 ft. in 45 min. In actual practice about half this would be good work. Not only can the machine be set to work in any position with no appreciable waste of time, either on a timber set or a plank thrown across two stulls, but in the number of feet drilled per shift it did walk all around the reciprocating drill in that particular rock, which was a quartz porphyry of average hardness, in a raise 10 by 6 ft., over 100 ft. above the adit-level. The ground was very heavy, and required timbering within a set below the working face. With the 2¼-in. drill the average progress of the raise was 1⅛ ft. per day, while with the hammer-drill it was 1⅝ ft. per day. This would indicate slow drilling or poor breaking in both cases, but for the fact that the time taken for timbering could not (under the conditions) be used for drilling.

The relative cost for labor was as 6½ to 2½ in favor of the hammer-drill, while the powder consumption would average as 10 to 7 in favor of the hammer-drill. Thirteen 4-ft. holes was a round with the hammer-drill; this was generally made in less than six hours, sometimes in five, while the 2¼-in. drill could not make a round in an eight-hour shift. After shooting holes made with the hammer-drill the hanging wall was clean and slick, while the charges fired in the other holes broke into the hanging wall, requiring lagging where none was actually needed.

The cost of repairs for the hammer-drill in six months was $2, outside of gaskets that could have been made at the mine at a nominal cost, but which cost us about a dollar per month. As there are few wearing parts, it is hardly likely that any reciprocating drill with automatic screw-feed could compare with such a simple machine in the cost of keeping the machine to its work, but it is possible that in very hard rock this may be the case.

The air-pressure in the compressor room was kept at 110 lb., and probably at the working face, some 7000 ft. distant, it was about 85 lb. We found that a high pressure was more essential with the hammer-drill than with the reciprocating, probably because the cylinder, being larger, afforded a greater range of pressure where the blow delivered would be able to break the rock in the hole. The strength of the blow is determined more by the pressure than the amount of air; although this is not logical in one sense, for the greater the pressure the more the volume of air taken in at atmospheric pressure, it illustrates the point that there is no economy in a low pressure. We found also that our compressor, a Norwalk, did better work, and was subject to fewer variations at 110 lb. than at 90 pounds.

I have observed in various mines the air-pressure at 85 lb. in the engine-room. Now, with a possible loss of

about 5 lb. for every thousand feet of pipe, it seems to me that drills are working at a disadvantage, for, whether with steam or air, my experience has been that the machines should work under a pressure at least as high as 80 lb. (at the drill), and preferably at from 90 to 100 pounds.

Portland Cement.

THE country is being carefully searched for material suitable for the manufacture of portland cement. Deposits thoroughly satisfactory in chemical composition and at the same time so situated as to permit profitable marketing of the product, are exceedingly rare. The raw mixture which by its clinkering and grinding forms portland cement should contain about 75% of carbonate of lime. One of the most serious difficulties is that of finding limestones low enough in magnesia. The usual limit in well-established specifications is 5% of magnesium oxide in the finished cement, although the amount is sometimes limited to 3%. When the magnesia is present to the extent of 10 or 15%, the appearance of the stone, the way it effervesces with dilute hydrochloric acid and its hardness indicate its presence to that amount; but when it is as low as 5 or 6%, it is not possible to form by superficial examination any estimate of the amount of magnesia. It is of great advantage to be able to determine in a few minutes, and at a point remote from a laboratory, whether a material will probably produce good cement. A simple test may be made as follows: After powdering the sample in a mortar, transfer a measured portion to a test-tube. Add to this 1.75 c.c. of hydrochloric acid and when effervescence has nearly ceased, boil for a moment. Then add enough pure calcium carbonate to neutralize the excess of acid. Boil until steam issues freely from the mouth of the test-tube, then add water and mix thoroughly by shaking. Filter this and allow the filtrate to run into another test-tube containing 1.5 c.c. of sugar-solution (a cold saturated solution of granulated sugar) and 1 c.c. of potassium-hydrate-solution (30 gm. of pure potassium hydrate to 100 c.c. of water) which have been diluted with water and thoroughly mixed by shaking. If magnesia is present, a precipitate of magnesium hydrate will form at the line of contact of the two solutions. Its density is roughly indicative of the percentage of magnesia in the stone. The percentage can be estimated pretty accurately by running a parallel test on stone of known composition. If small pieces of the rock under investigation upon being treated with dilute hydrochloric acid in a test-tube disintegrate entirely, clay or shale will have to be added to the limestone; if the action of the acid ceases before all of the carbonate is dissolved and recommences when the clayey covering of the splinter is rubbed off, the stone is apt to need the addition of a purer limestone; but if all of the lime carbonate is dissolved yet the splinter retains its shape, the stone probably approaches closely the proper composition for portland cement.

RESPIRATORY APPARATUS IN FRENCH MINES.—Every mine in France employing 100 men underground at the same time must be provided with portable respiratory apparatus, ready for immediate use and allowing a miner to remain at least one hour in an irrespirable atmosphere. The number of these apparatus must be not less than two for each pit, placed in charge of an engineer or inspector familiar with their working, and provided with ten picked men, who will be trained in the use of these apparatus and sent to the seat of danger immediately whenever the necessity arises.

Decisions Relating to Mining.

Specially reported for the MINING AND SCIENTIFIC PRESS.

The issue of patents for lode mining location was a recognition by the Land Department of the conformity of the proceedings to the local rules and customs of the district, and such ruling could not be challenged by third parties claiming rights which arose subsequent to the notices.

Lawson *v.* United States Co., 28 Superior Court Reporter 15, Oct., '07.

Priority of entry and patent alone does not conclusively establish seniority of location, so as to give the holder of a lode mining claim under such a patent the right to the entire width of the vein on its dip, where part of the apex of such vein is within such claim and part within an adjoining claim.

Lawson *v.* United States Co., 28 Superior Court Reporter 15, Oct., '07.

Where a mining lease provided for the payment to the lessor of a part of the net proceeds of minerals taken from the land, but contained no stipulation for a forfeiture through failure to open and work the mines, the law will construe the contract as if such a stipulation had been expressly written therein, and will adjudge such lease to be forfeited if within a reasonable time the lessee failed to carry out the purposes of the lease.

Starn *v.* Huffman, (W. Va.) 59 Southeast. 179, Oct., '07.

The owner of land conveyed the same by deed without reservation as to minerals. The grantee immediately deposited his deed for record. On the following day, in the presence of the first grantee, the original grantor executed and delivered to another person a deed for the minerals under such land, and in the presence of the first grantee, received the purchase price of such mineral. Under such circumstances, the original grantee was estopped to claim any interest in the minerals. While the purchaser of the minerals had constructive notice of the first deed, his conduct in paying the consideration for the minerals was sufficient to inform the first grantee that he had no actual notice of the original conveyance, or he would not have paid for the minerals knowing that the land had been conveyed to another. The conduct of the original grantee operated as a fraud upon the grantee of the minerals.

Virginia Co. *v.* Campbell, (Ky.) 105 Southwest. 129, Nov., '07.

The lessee of lands for drilling for oil and gas under an agreement to pay an annual rental for the time the wells produced gas in marketable quantity, was held liable for the rental only during the time such wells were so producing gas during the period for which such rental was claimed.

Roberts *v.* Fort Wayne Gas Co., (Ind.) 82 Northeast. 558, Nov., '07.

Under a lease of a certain vein or seam of coal for a term of years, the lessee to leave the mines in good condition for future working; and conditioned also that the lessee should remove from the vein leased 100,000 tons of coal of a size which would pass over a screen of §-in. aperture in each and every year of said term, it was decided that the lessee could not remove, after mining, such broken coal as would pass over the §-in. screen.

Hollenback Coal Co. *v.* Lehigh Coal Co., (Pa.) 67 Atlantic 897, Oct., '07.

Where a quantity of coal warranted to be of a certain grade was sold, but by mistake coal of an inferior grade was delivered, this did not relieve the seller from liability for damages and the measure of damages was the difference in the prices of the different grades of coal.

Missouri & Illinois Coal Co. *v.* Consolidated Coal Co. of St. Louis, (Mo.) 105 Southwest. 682, Dec., '07.

United Verde Mine.

By L. C. Graton.

*The production of blister copper in the Jerome district of Yavapai county, Arizona, in 1906 was about 38,500,000 lb., a notable increase over 1905. This came wholly from the United Verde mine.

The United Verde orebody occupies a zone of shearing so intense that the containing rock, a rather basic porphyry, has here been converted into a schist. Pyrite, chalcopyrite, and some zinc-blende, with varying amounts of quartz, have in places partially or completely replaced the schist, and in other places the schist is injected by veinlets and stringers of sulphides and others of quartz. As a rule the more massive sulphide ore contains more iron and zinc, while that consisting of alternating bands of sulphide and schist—the so-called 'slaty' ore—carries a much higher proportion of chalcopyrite. The ores are undoubtedly of pre-Cambrian age, like the inclosing rocks, and closely resemble certain pre-Cambrian copper ores from the Rocky Mountain region of northern New Mexico. Almost the entire output in 1906 came from sulphide ores, but a little oxidized ore, rather high in gold, added to the production. The ores mined are all of smelting grade and carry a high percentage of copper, the average yield in 1906 having been considerably above that of Bisbee and much higher than that of the other large pyritic deposits of Bingham, Shasta, and Ducktown. The content of the ores in gold and silver is decidedly higher than in any other of the large Arizona copper camps and far above the precious-metal yield of the pyrrhotite ores of Ducktown, although not very different from that of the Bingham and Shasta ores.

So far as present developments have shown, the orebody is an irregular rudely lenticular mass of large dimensions. The surface outcrop of the lens was about 800 ft. long. The shoot pitches northward and undoubtedly extends along the pitch beyond the region explored to date. There is some reason to believe that a fault, which brings the schist up even with the Paleozoic sediments close by, passes just west of the orebody, and it may be that the deposit now known is but the eastern section of a body whose remaining portion lies at an indefinite depth below the sediments.

Extraction is effected through shafts, although there is a tunnel reaching the 500-ft. level, and a new tunnel is being driven in 1907 to strike the lowest level of the new 1000-ft. shaft. Motor haulage is used on the principal levels. Square setting is employed only where absolutely necessary, and the use of timber is avoided as much as possible, owing to danger from fires. Native round timber is the kind most used. The system now prevailing is overhead stoping with horizontal back, and filling kept up within working distance. Work is carried on in certain portions of the 'fire country' by the employment of the plenum air-pressure system originated at Iron Mountain, Cal. The developed workings are not very wet, but considerable surface water finds its way into the mine through the caved ground, and, passing through the burning stopes, takes up copper and sulphuric acid. An extensive system of flumes allows the precipitation of most of this copper. The district is served by a narrow-gauge line owned by the company, which connects with the Santa Fe, Prescott & Phœnix. Oil is the principal fuel. European labor is extensively employed, but the wages are high, the pay for work in the fire country being $4 per day.

All the higher sulphur ores are roasted before smelting, the claim being made that the ores carry too high alumina to make pyrite smelting successful. The highest-grade ores are lower in sulphur and are smelted direct. It is an interesting fact that ore extracted from stopes which had been on fire for several years is oxidized only slightly, and not at all except along fractures. Limestone flux is quarried along the railroad near the mine. Silicious material is encountered in the workings in sufficient quantity to supply converter lining. The coke, which averages 10% of the charge, is from Colorado. The settling of ground under and around the smelter appears to have ceased, and a new 20-ft. furnace is being added in 1907. The ground considered as ore reserves in 1902 was lost to immediate availability by the fire and attendant caving. These stopes are now gradually being reclaimed, but most of the ore now being mined comes from stopes that were unknown three years ago.

Map of Arizona.

LOW-GRADE CHROMITE ORES may be concentrated into a commercial product. This is done at the Black Lake No. 1 mine in the province of Quebec, Canada. All ore carrying between 10 and 40% chromite is put through a jaw-crusher and a stamp-mill. After it passes through a 22-mesh screen it goes to Wilfley tables; the resulting concentrate carries 50 to 51% chromite. The best of the tailing from the tables is run to another table, and the resulting concentrate has 10 to 13% chromite.

*Abstracted from 'The Production of Copper in 1906.' Advance chapter from 'Mineral Resources,' U. S. Geological Survey.

The Fault Problem.

By T. C. CHAMBERLIN.

*The general conception of the relations of thrust to tension in the outer part of the earth's shell, which constitutes the soul of the views herein submitted for trial, is not without important bearings on ore deposition. Far from making the two systems of faulting mutually exclusive, and the presence of the one an argument for the absence of the other, the one is made to presume the other, in the following sense: The great bulgings of the outer part of the earth, which are assigned to compressive deformation and are accompanied by compressive faulting, are made the conditions precedent to the creep-faulting, since these are made dependent on the gravity-differentiations to which the bulging gives rise. The creep-faulting obviously follows the thrust-faulting in time when the two are thus genetically related, with an interval between. This sequence is believed to be economically important. Compressive stresses may be competent to rive the shell extensively and deeply, but they do not furnish conditions favorable to the gaping of the fissures, in general, but quite the reverse. While the compressive stress is on, the permeation of water, of whatever source, and in whatever direction tending, is antagonized, in the main. Given a pressure equal to 5 or 6 miles of rock-load, and penetration is practically prohibited. Much inferior stresses are competent to force the blocks of the shell into close contact and restrain circulation. Compressive stresses, taken in general, and neglecting attendant special cases, may be serviceable to vein deposition in the preliminary act of fracturing the rock, but to this their immediate serviceability seems to be largely limited.

The succeeding relaxation assigned to creep is, however, precisely the ideal agency required to complete the conditions for free circulation and for the reception of vein deposits and all related deposits. This is not solely limited to those cases in which the ore is deposited in the gaping fissures thus prepared for it, but also includes replacement, impregnation, and other deposits which are dependent on the free admission and exit of waters through the avenues opened by the relaxative movement. So also, in so far as the deposits are dependent on the leaching of the rocks by waters, either superficial or deep, they are probably also largely dependent on the opening of the fractures by the relaxation of the pressure and the setting in of creep. The very slowness of the assigned progress of creep is favorable for the development of vein-filling, for it provides a slowly increasing receptacle for the slow process of deposition. The alternations of tension with minor episodes of compression, incident to the creep process, as previously pointed out, afford a ready explanation of many of the complexities of vein structure, especially those which show successions of growth, with intervening crushing, on the one side, and infalls, on the other.

The length of the interval between the compressive stage and some known phase of the relaxative stage may be such as to be very suggestive, if not decisive, as to the conditions that controlled the ore deposition. The interval may have been so great and the physiographic changes so notable, as to leave little or no question that the circulation was that controlled by the relaxative conditions in distinction from those of the compressional stage, and it may thus throw the mode of deposition necessarily into the class or classes compatible with the relaxative stages only. This is not a mere academic deduction. It is a conviction forced upon my attention from studies in some of the mining regions of the West. While these studies were of a limited sort, I do not think I am in error in urging attention to the distinction between the conditions of the compressional and relaxative stages in regions of great relief, and to the time interval between these.

The distinction between compressional and tensional conditions is probably also important in studying those ore deposits that are associated with igneous action. If I am correct in assigning volcanic action to the solution-fusion effected by the rising temperature of the middle zone, and in supposing that the fluid material is forced to the surface about as fast as formed by the differential stresses of the tides and other agencies, effusions of lava should be liable to take place at almost any stage of the earth's history, compressional or relaxative, and this is the general import of the geologic record. If the lava encounters the crust in a compressional condition, its egress is not only hampered but it is forced to occupy every available cavity and weak spot not only by its own hydrostatic pressure and elastic contents, but by the ascensional stresses which actuate it, and little or no adjacent space or porous rock is likely to be offered for ore depositions, which are thus constrained to limited diffusions and impregnations of the environing formation and to segregations within the lava itself. Not only this, but the prevailing compressional condition tends to prevent the opening of fissures after the lava has so far solidified as to prevent its occupying the fissures itself, and hence the secondary conditions that normally follow an igneous invasion are delayed. Almost the only line of relief from these restraining conditions is found in the doming of the shell above the intrusion with incidental tensional openings.

On the other hand, lava seeking exit through the crust when in a tensional state and affected by open fissures, is less forced to strenuous insinuation, and is more liable to leave minute fractures and porous zones uninvaded. Through these, magmatic waters may go out and meteoric waters may come in and promote deposition. As soon as the exterior of the molten mass cools and its penetration of the adjacent formation is stopped, fissures may freely be opened by the progressive relaxation normal to the tensional state, and circulation outward and inward be facilitated, while at the same time appropriate receptacles for the ores are prepared by the mechanics of relaxation and by the solvent action which the free circulation permits.

Because of these and similar considerations, I believe that if we can reach the heart of the major phenomena of tensional and compressive faulting, we will be on the road to the elucidation of one of the great classes of ore deposition, while the mechanics of faulting will find their solution as a necessary incident.

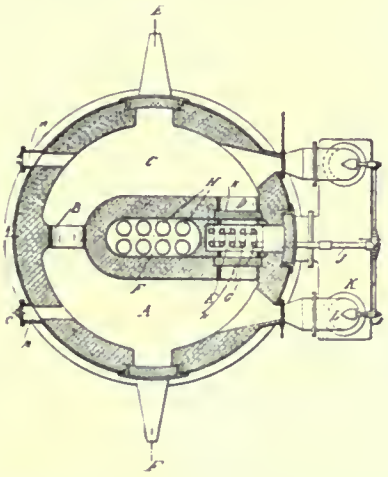
*From *Economic Geology*, October-November, 1907.

WHY MONEY IS SCARCE.—Many theories are advanced as to the principal causes of the scarcity of funds that has existed for a long time, says the *Wall Street Summary*. A banker in this city who has made a close study of the question, and who has been extremely conservative for many months, principally because of the monetary situation, says that he believes that a large amount of money is in the hands of laborers, artisans, and others whose wages have been very materially increased within recent years. He believes that people of this class are carrying about a much larger amount of money than ever before. Others who hold this same theory point to the fact that the newly-arrived foreign element is receiving much higher wages than was ever paid to that class of people until a few years ago, and that many of them hardly know what a savings bank is, and consequently are simply hoarding their savings.

MINING AND METALLURGICAL PATENTS.

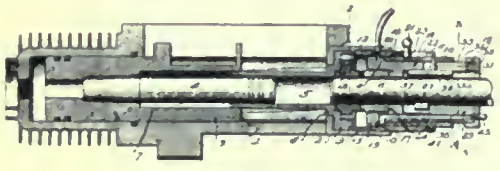
Specially Reported for the MINING AND SCIENTIFIC PRESS.

SMELTING-FURNACE WITH OIL FIRE.—No. 876,275; August Koch, Hanover-List, Germany.



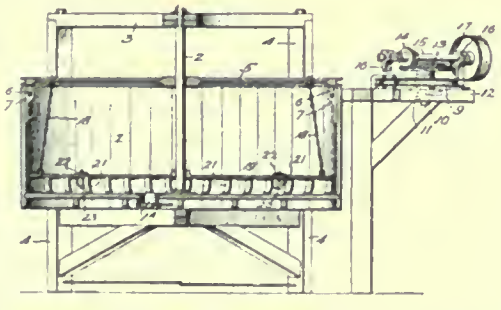
In a furnace of the character described, the combination of a plurality of chambers adapted to be alternately used for melting and preheating, oil vaporizing and air heating chambers located between said melting chambers, so that the heat radiated by the melting chambers will vaporize the oil and preheat the air in said air and oil chambers.

ROCK DRILL.—No. 875,869; Rolland S. Trott, Denver, Colorado.



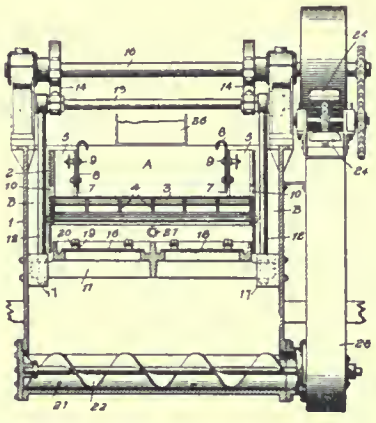
In a rock drill for changing drill-bits without stopping the engine, a cylinder, a reciprocating, non-rotative piston mounted therein, a pawl and ratchet and rifle toothed drill-bit rotating mechanism connected to said piston, a drill-bit in the reciprocative path of said piston, a drill-bit holding chuck arranged to hold said drill-bit and means including a clutch device for throwing said drill holding chuck into or out of engagement with said drill-bit rotating mechanism when said piston and drill-bit rotating mechanism is in operation.

APPARATUS FOR AUTOMATICALLY DISCHARGING ORE-PULP SANDS AND OTHER MATERIAL FROM TANKS.—No. 875,876; Jeremiah C. Winchell and Howard H. Winchell, Monte Vista, Colorado.



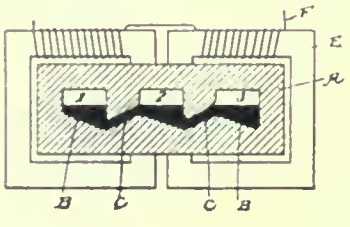
An automatic ore-sand discharger for cyanide tanks, comprising a tank, a shaft in the centre of said tank, a closable discharge aperture in the bottom of said tank, a scraper pivotally and slidably mounted on said shaft within said tank, a rotating sheave rotatably mounted on said shaft, and connected to said scraper by a flexible scraper rotating connection, and means for rotating said sheave.

APPARATUS FOR WASHING COAL, ORE, ETC.—No. 876,268; Alfred J. Diescher, Pittsburg, Pennsylvania.



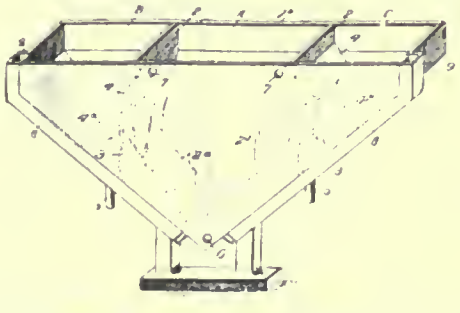
In a machine for washing coal, ore, etc., the combination of a tank having a main and one or more secondary compartments, the main compartment having an outlet for the discharge of light material, a screen arranged transversely of the main compartment below the level of the outlet therefrom, the main and secondary compartments being connected by open ports located above the screen and permitting a free flow of water from the main to the secondary compartments and means for maintaining a flow of water up through the screen and through ports leading to the secondary compartment or compartments, substantially as set forth.

CONSTRUCTION OF INDUCTION ELECTRIC FURNACES.—No. 875,801; Gustave Gin, Paris, France.



In a furnace of the type set forth, a hearth provided with a plurality of receptacles for molten metal, each having a longitudinally inclined bottom, laterally closed conduits connecting said receptacles and electro-magnetic means adapted to set up an induced electric current in metal contained in said receptacles and conduits, substantially as and for the purpose specified.

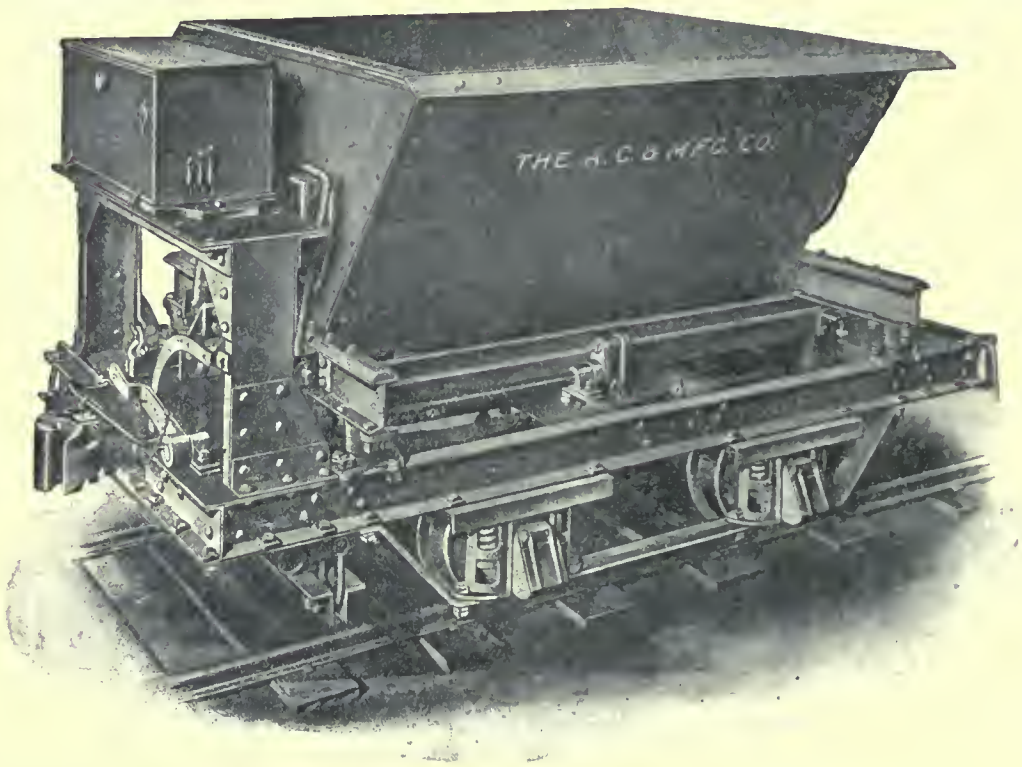
WATER-ECONOMIZER FOR JIGS.—No. 875,850; Thomas Rowe, Dollar Bay, Michigan.



In an apparatus of the character described, a receptacle for the reception of tailing, said receptacle having sloping side walls and formed in its front wall at the bottom thereof with a discharge outlet and also formed near the upper edge of its front wall with outlet orifices, and overflow launders connected to the sides of said receptacle and extending down underneath said sides and discharging at the lower ends thereof.

Scale Charging-Car.

Through the courtesy of the Atlas Car & Mfg. Co., of Cleveland, Ohio, we are able to present to our readers a new type of scale charging-car, such as is used around smelting works and furnaces. The car is moved either by hand, or by small locomotives. This type of car can be built from 30 to 150 cu. ft. capacity. It is intended to empty on either side of the track. The body being practically balanced and held in position by two bales, one on either end of the body, the car is adapted so that one man can manipulate it. The centre of gravity sets low, which insures easy riding. The hopper is made of steel plates, re-enforced around the edge and on the ends, on malleable iron rockers. The rocker ways are tapered so that no material can lodge where it would impede the hopper. A sub-frame is provided; it is made of structural material and well braced. The end thrust is taken up in the centre as well as at the ends. Cross-frame supports are provided, also a check chain, to hold hoppers from going too far. The main frame is provided with four cone-shaped steel castings, which fit into corresponding male castings secured to the sub-frame. When the car is in motion it is intended that the sub-frame is setting on cone supports. This holds the mechanism in true alignment when the scales are out of action.



Scale Charging-Car.

The relieving device is a new feature, taking the entire scale mechanism off the pivots and knife-edge when the car is in motion. When material is to be weighed the movement of the lever, shown on the platform, brings the scale into action, through the medium of a link connected to the main lever. This takes off the wear and friction of the knife points, also the strain, adding to the life of the scales and accuracy in weighing. The scale-box is known as the Miller type, having the beams parallel with each other instead of vertical as in the Realy and other types. On the ends of the box are three triggers. These are used when material is to be weighed. The beams are brought into action by lowering the trigger to be used, each trigger representing a beam. The tare beam is not indicated. As many as seven different materials for charging may be weighed on these cars, depending upon the number of beams. An indicator is provided on the outside of the box, showing the action of the beams, in order that the operator can apply the right amount of material to the hopper. Each box is provided with a Yale lock to prevent tampering. Proper means of adjustment is provided for all wearing parts. The main car-frame is composed of heavy I-beams which are well trussed and braced with intermediate channels and plates so as to keep them in alignment. End thrust on body and scale mechanism is well taken care of, as the shunting of such cars is excessive. The wheels and axles are made heavier than usual, also boxes are made of malleable iron, pedestals of malleable iron, with duplex springs, bronze bearings, and ample space for oil waste. The duplex springs prevent the jar on the scale mechanism and add to the life of the car in general. Owing to the fact that the smallest curves are necessary to the economical handling of such cars around smelters and furnaces, an automatic radial draw-bar is designed so that these cars can radiate in trains without side friction or binding. Cars can be coupled on a curve or in any position, also uncoupled through the uncoupling lever, by standing on the outside of the cars, thereby facilitating the handling of them. The Atlas Car & Mfg. Co. designs cars of all classes for smelters and mines, this being one of the latest. The shops are especially adapted for producing duplicate work of this sort to the best advantage.

Catalogues Received.

THE WOOD DRILL WORKS, of Paterson, N. J., is distributing a circular containing testimonials as to the merits of the Wood drill.

THE MURRAY IRON WORKS CO., of Burlington, Iowa, has issued its Series D, No. 7 catalogue entitled 'Nomenclature of Murray Corliss Engines.'

THE L. C. TRENT CONTINUOUS FILTER CO., of Reno, Nev., has sent us its 'Bulletin No. 1,' which describes its continuous filtering and straining machines.

THE WEBBER GAS ENGINE CO., of Kansas City, Mo., has issued 'Brochure No. 55,' containing a statement of the advantages of using gas power instead of steam power.

THE ELECTRIC CONTROLLER & SUPPLY CO., of Cleveland, Ohio, has issued a finely illustrated catalogue entitled 'Lifting Magnets.' The Type S magnet is extensively used for loading charging boxes for open-hearth furnaces, and for a great variety of other purposes involving the transferrence of pieces of iron or steel; the Type F magnet handles ingots and billets, and the Type R magnet large irregular pieces of iron.

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Editorial.

OUR DISCUSSION DEPARTMENT has been honored by the information concerning green gold given by Mr. Thomas K. Rose, chemist to the Royal Mint, and Mr. Frank A. Leach, director of the United States Mint. In this issue Mr. Leach records the latest experiments devised to ascertain the cause of the color of green gold.

IN OUR ISSUE of January 18 we published a thoughtful article by Mr. Frank A. Ross, criticizing the Lemieux Act, which was intended to deal with industrial disputes in Canada. Since the article appeared, the commission, appointed under the Act, has held a long session at the St. Eugene mine, of the Consolidated Mining & Smelting Company, at Moyie, and the result was that the men refused to accept the scale recommended by the commission, so that mining operations have definitely ceased. This confirms the judgment expressed by Mr. Ross.

WE NOTE with pleasure that excellent selections have been made for officers of the Institute this year. There have been times when the nominations have been anything but representative, but the circular just to hand indicates unusual success in the choice of members to serve on the council. Mr. Hammond remains president. For new vice-presidents we shall have J. Parke Channing, John B. Farish, and F. W. Denton; no worthier representatives of American mining engineering could be found. For new councilors, we shall have W. H. Shockley, C. R. Corning, and R. V. Norris; here also we find men of the highest reputation and admirable exemplars of correct practice. The election takes place on February 18, but it is a formality only. Fortunately, the members of the Institute have been well served by the nominating committee—a mysterious entity, but evidently highly intelligent.

PERSISTENT RUMORS have been current on Wall Street to the effect that the Guggenheim family had lost control of the American Smelting & Refining Company, and that the Standard Oil coterie was now dominant in the affairs of this important corporation. Thereupon Mr. Daniel Guggenheim came out with a positive denial of any such change, asserting that he and his friends had been loaning money, not borrowing it. Unfortunately it is considered proper nowadays in business to make statements that may be technically correct although inferentially wrong, so that a *dimenti* is often unconvincing. We have reason to believe that the Guggenheims have had to borrow heavily during the past year and in doing so they have been compelled to hypothecate some of their shareholdings.

but that they have managed to retain command despite some degree of financial embarrassment. And we can say with the utmost sincerity that we would be the last to welcome the further ascendancy in mining of the Standard Oil people; the heavy hand of that unscrupulous organization is already laid upon too much of American industry. In this connection we refer our readers to an abstract of the Government report on the petroleum industry, appearing on another page of this issue.

MOST OF US have heard of theoretical extractions that failed of fulfilment. We have heard of mills that made a 60 per cent extraction on top of a 90 per cent estimate, and the difference has been credited to absorption by the copper plates in a stamp-mill or the wooden staves of the cyanide vats; and such transfers of responsibility have held good until that day of judgment coming to all erroneous engineering calculations. But we can now record an advance upon earlier practice in this regard. The management of a large mill in Sonora made a shipment of precipitate to the refinery at Omaha. In order to value the shipment, the figure giving the average daily tailing was subtracted from that representing the average mill heading. Upon receipt of the smelter returns, it was found that the precipitate was much less valuable than expected, so what did they do but bring a claim against Wells, Fargo & Co. (who transported the shipment) for the entire theoretical discrepancy, and then the amount of the claim was entered on the books as an asset!

State Mining Bureau.

ON THE LAST DAY OF 1907 Mr. Charles G. Yale was dismissed from the post of statistician to the State Mining Bureau. This fact was known to us at the time, but no mention of it was made pending a protest presented to the Governor by several representative men. The official chief of the Bureau is the Mineralogist, who, at this time, is Mr. Lewis E. Aubury. The Governor of the State and the Trustees of the Bureau alike protested against the summary dismissal of a man so long honorably identified with the Bureau—a man whose name carries more of authority in mining affairs than that of half a dozen State Mineralogists—but as Mr. Aubury owes neither his nomination nor his tenure of office to either the Governor or the Trustees, he declined to reconsider his action. It was fitting that the episode should be completed by the selection, as a successor to Mr. Yale, of Mr. David H. Walker, a reporter on the *Call*, a daily paper to which Mr. Aubury is indebted for many flattering notices. We forbear from further attack upon the present State Mineralogist, for he is only a link in a disgraceful system, but we deem it our duty to lay certain facts before our readers, in the best interests of the mining industry of California.

The office of the State Mineralogist of the State of California has been in the gift of the Southern Pacific Company for twenty years. W. H. Irelan was the nominee of George Hearst, senator and railroad henchman; J. J. Crawford was given the appointment by John Wright, political manager at Sacramento for the railroad company, because Mr. Crawford handled the El Dorado county delegation for Wright; A. S. Cooper was put into office by the manager of the Pacific Improvement Company, a subsidiary of the railroad company. One man was made Mineralogist in order that he might examine the coal deposits in the interest of the Southern Pacific, but at the expense of the State; another man was given the appointment in the expectation that he would investigate the oil-fields for the Southern Pacific. Then came Lewis E. Aubury, whose term of office has been signalised mainly by a fight over timber lands in Plumas county, nominally in the interest of the State, actually in behalf of the Southern Pacific; nominally against H. H. Yard and others, actually against the Western Pacific. The public has been bamboozled into believing that this fuss about fraudulent land entries was prompted by the call of duty; it is all flimflam. So far as we know the evidence indicates that the procedure of H. H. Yard and his associates is such as any citizen might legally follow regardless of railroad affiliations. Whether the claims located cover real placer ground or valuable timber land it is for the Federal officials to say, for it is government land absolutely. From an economic point of view, the State of California profits equally whether the land is made to produce lumber or gold. Not only is it no part of the duty of the State Mineralogist to investigate land frauds, but the Federal authorities, who are responsible, have made an enquiry and it is known that the Commissioner of the Land Office has not seen fit to invalidate the entries attacked by Aubury. It is hardly necessary to add that we have no motive in making these statements save the desire to serve the community; Messrs. Yard and Aubury, the Western Pacific and the Southern Pacific are to us only representatives of conflicting interests; the MINING AND SCIENTIFIC PRESS is not bound by a single political or financial thread to anyone.

To return to our story: By reason of Mr. Aubury's incompetence, an effort was made to prevent his re-appointment at the end of 1906, and soon after his belated re-appointment by Governor Pardee it was arranged that he should resign on or about March 1, 1907, with the understanding that Mr. Ross E. Browne should succeed him, as was stated in our issue of July 27. We need not tell our readers who Mr. Browne is, nor how eminently fit he is for the office designated. Mr. Browne had just returned from South Africa and was unwilling to undertake the work of re-organizing the Bureau, until it was urged upon him by Mr. Yale, by the Trustees, and by other friends. He finally agreed to take the post for at least one year, long enough to put its affairs on a better basis. In the meanwhile Mr. Aubury was to resign gracefully, to accept a lucrative appointment in the Land Department of the Southern Pacific. Mr. Browne was offered the place of State Mineralogist by Mr. W. F. Herrin, the political agent of the Southern Pa-

cific. It is now proper to inform our readers that the Governor of California is a Mr. James N. Gillett, but he did not appoint Mr. Browne nor arrange for Mr. Aubury's resignation. Why should he? Mr. Herrin made him Governor, so why make even a pretence of possessing the appointive power. Mr. Herrin arranged everything. But Mr. Aubury did not resign after all; he submitted that he was engaged in important work, to wit, the prevention of timber-grabbing in the northern part of the State, that is to say, the hindering of the construction of a rival transcontinental railroad. His reasons for retaining office satisfied Mr. Herrin; what the Governor thought, does not matter.

Now we return to the dismissal of Mr. Yale. Charles G. Yale is known wherever the mining industry of California is known, for 23 years he was editor of the MINING AND SCIENTIFIC PRESS, he was one of the founders of the California Miners Association, for many years he has been in the employ of the United States Mint and of the Geological Survey—in fact, for the time of a whole generation he has been foremost in all that concerns the systematic recording of mineral production and mining advancement. He has been statistician to the Bureau for 15 years. Out of 49 bulletins issued by the Bureau he himself wrote not less than 25; out of the 8 issued since the earthquake-fire he has written 7; he edited and prepared for the printer (including index) all of the 49 bulletins, save 3. Mr. Aubury has been the State Mineralogist for 6 years and during this period he has not written one bulletin or report, although his name is attached to the copper bulletin, of which he did not write a single line. On the whole, the work of the Bureau during recent years has been unworthy of its high-sounding name; tons of field reports have been consigned to the paper mill, because the material is unfit for publication. What the Bureau has done, outside of Mr. Yale's reports, is scarcely worth mentioning. The last important contribution to technical literature was the bulletin on dredging, the best of which was the work of John D. McGillivray, although the authorship is credited to a genial politician and promoter who is now across the divide. The present State Mineralogist had no special training for the work, he is a regrettable accident. It might be supposed that the Trustees of the Mining Bureau would have adjusted affairs; the personnel of the board was indeed of such a character as to warrant the highest expectations; namely: Curtis H. Lindley, F. W. Bradley, E. A. Stent, Louis Janin, and Harold T. Power. It would be difficult to select men better fitted to represent the mining industry of California. The first three of these gentlemen resigned two months ago and they have been succeeded by Frank Griffin, A. H. Ward, and T. C. Deane. But the Trustees act merely as an auditing committee, with no authority to direct the work of the Bureau nor to advise concerning the expenditures; they are trustees only in name. For instance, all of the members of the old board joined in recommending the selection of Mr. Browne, just as the new board protested against the dismissal of Mr. Yale, but to no effect. Nevertheless, the present Trustees can be held responsible for the appointment of Mr. Walker in place of Mr. Yale, if it becomes a fact, for the law of California says that all appointments of the Mineralogist shall be made "subject to the approval and confirmation of said board of trustees, and shall not become effective unless so confirmed and approved."

This is the truth in all its naked ugliness. Shall we blame Aubury? Yes; but that will do no good. He is ephemeral; the conditions that put him where he is, will persist. Shall we attack W. F. Herrin? That also is useless, for were he to resign tomorrow, his work would be perpetuated by another of the same kind. Shall we anathemize the Southern Pacific? Even that is wasted breath, for the railroad company's malign activity in politics is the result of conditions; it did not create them. If the people elect a legislature that can be bought like a sack of potatoes, and if the railroad company is in danger of proscription unless it bribes the legislators, can you blame the railroad company for defending itself first and then trespassing on the rights of others? We do blame the railroad company and its officials for corrupt practices and subversion of law, but we charge a large part of the disgrace of such procedures to the people, to the voters—and especially the non-voters. We blame you, Sir, who think politics a dirty business and neglect your civic duty; you, Mr. Professor, who cannot spare the time to vote because you want to be on the golf tee early on election day; you, Mr. Merchant, who consider legislators—even the best that money can buy—as outside your ken. The stream cannot rise higher than its source and if the people will not attend to their civic duties, then incivism becomes rampant, and you get your Auburys, Herrins, and Gilletts.

You say this is not practical and that it devolves upon criticism to be constructive. We admit it. At the present time the people of the State are getting nothing from the Bureau save its museum and library. The Bureau could be an immensely useful institution, but it never will be while it remains an appanage of the Southern Pacific Company. Unless it can be divorced from politics and put into the hands of competent men, it would indeed be better to reduce the Bureau to the status of a library and museum. The public imagines that it is represented by the Trustees; they are but a blind to the corrupt play of politics. That is why Messrs. Lindley, Bradley, and Stent resigned. They found that their recommendations were disregarded, that they were asked to audit expenditures over which they had no control and into which they could make no effective enquiry. Until the administration of the Bureau is put on an intelligent foundation, no honorable man should accept office either as Mineralogist or Trustee. We hope Mr. Browne will not dishonor himself by accepting office from the political agent of the Southern Pacific and we ask that the present trustees, especially Mr. Janin and Mr. Power, both men highly respected in this community, resign from an office that is a sham.

The remedy is fairly obvious: The Mineralogist should be chosen by the Trustees and he ought to be

answerable to them; the Trustees ought to have terms of varying length and vacancies should be filled by the survivors, after the manner of the Public Utilities Commission of New York State. The first board of Trustees should be selected by the Governor, acting under the advice of a committee representing the organized business and professional interests of the State, such as the Chamber of Commerce, the Merchants Exchange, the Miners Association, and so forth. If the character of the first board came up to that of the Trustees actually selected three years ago, there would be some guarantee of the fitness of their successors, under the plan adopted in New York. Then, but not until then, would the position of State Mineralogist be filled by a man of the Ross E. Browne or Charles G. Yale type. As now administered, the Mining Bureau is a mere exhibit of the corrupt influence of railroad politics and a disgrace to the State of California.

The President's Message.

AFTER we had gone to press last week, we read the message transmitted to the Congress of the United States by the President; if it had been published earlier, some comment would have appeared in these columns: for we are among those that consider his messages important. It is a sufficient commentary on the poor journalistic enterprise and the un-American slowness of even our least bad San Francisco papers that they should not give any editorial comment on so important an event until nearly 48 hours after the message was received and that even then their remarks were trivial to a degree. *The Chronicle*, the owner of which is one of the most vivid examples of the predatory rich so seathingly rebuked by the President, says: "In a little over a year the President will be free to devote his entire time to the lecture platform." But even this ultimatum required 36 hours of cogitation. It is not necessary for us to define the nature of the grand work done, in so unconventional a manner, by the President, for on the very day his message was read at Washington, it was said by Mr. Charles E. Hughes, the Governor of New York—a man no less his rival in politics than he is his rival in the work of constructive statesmanship—that the administration of Mr. Roosevelt "has impressed the popular imagination and won the confidence of the people. The country is under lasting obligation to President Roosevelt for vigorous opposition to abuses and for the strong impulse he has given to movements for their correction. Differences of opinion now, as always, exist with regard to the best means of solving some of the extremely difficult problems that are presented. But those who earnestly desire progress and the establishment of our security on its necessary foundations of fair dealing and recognition of equal rights appreciate the great service he has rendered and the fundamental importance of the purposes he has had in view. We shall have in the next campaign a notable vantage ground, gained through the general admiration of his strong personality and the popular appreciation of the intensity of his desire to promote the righteous conduct of affairs and the welfare of his fellow men." This is a tribute as true as it is generous. There can be no question that to Mr. Roosevelt it has been given to be the spokesman for the American people to a degree unknown in American history, for even Lincoln was the representative of only one party, while Mr. Roosevelt has won the support of the people generally and even the commendation of the acknowledged leader of the Democrats. We confess to an enthusiastic belief in the usefulness of the work he has done, and is doing; and while aware of many blunders committed by him, by reason of a curious blending of personal impulses and machine politics, we hold that these very mistakes have confirmed the belief in his sincerity, for the blunders have been small while the splendid purpose of his policy has been made repeatedly manifest. To those not entangled by politics and finance, it is amusing to watch how the predatory financier and the politician of the corrupted and corrupting kind are joining hands in their bitter hatred against Mr. Roosevelt, because he has dared to spoil their game. They have been used so long to the complacent type of President, like McKinley, that they protest in the manner of Russian grand-dukes or the Hohenzollern themselves when their privileges are endangered. Here in San Francisco we have heard what are called in the drivel of the daily paper 'magnates,' that is, presidents of street car companies and successful promoters, talk of the effort to rid our City of its municipal corruption, as if the law officers were a mob and they, the 'magnates,' hereditary autocrats. The thing is pathetic, for these men that arrogate the attitude of a privileged class were plain workmen, or not so good, only twenty or thirty years ago. In a real democracy neither wealth nor privilege should determine a man's status, but his conduct. In Europe high birth will throw a halo around a low act; in America great wealth will give glamor to grand larceny; both ways of thinking are stultifying, both are destructive of any real ethical standard. Worth makes the man: to those that are of good birth as to those that are possessed of great wealth, there is simply an added obligation, as there is usually a better code of conduct. The *noblesse oblige* of Europe should be translated into the *obligation of riches* in America.

It is a curious fact that Mr. Roosevelt is esteemed highest by the plain people of his own country and by observant foreigners across the Atlantic. In both cases his hold on their imagination is due to the fact that he has succeeded to an astonishing degree in expressing the trend of general opinion, not as a groveling politician with his ear to the ground but as a great tribune thoroughly in touch with the tendencies of his day and generation. Even if regarded in the least sympathetic way, he is a safety valve for the pent-up protest of an industrial community heartily sick of the industrialization of all that makes life worth living, of a people that is beginning to ask, in the eloquent words of the president of the University of Virginia: "Can we industrialize our lives without commercializing our souls?"

Personal.

R. GILMAN BROWN is in Chile.

RICHARD PEARCE is in London.

WALTER H. WEED is expected at Guanajuato.

MARK L. REQUA has returned from New York.

C. W. MORSE has returned to Berkeley from New York.

JOHN E. HARDMAN has changed his office to 112 St. James St., Montreal.

E. C. D. MARRIAGE, recently of Pioche, Nevada, is on a visit to London.

D. CURRIE, of Lake & Currie, sailed from London for Australia on January 30.

T. M. LOWAY, of Camborne, Cornwall, has sailed for the Gold Coast, West Africa.

N. M. ZOPH has gone, with Douglas Waterman, to the Ponderosa mines in Chile.

UTLEY WEDGE, of Philadelphia, has been visiting the smelters near San Francisco.

C. M. FUELLER has returned to Denver from the examination of mines in Nevada and California.

H. W. TURNER has moved from Portland to San Francisco; his office is at 502 California Street.

LEWIS T. WRIGHT sails from New York on February 8 by the *Lusitania* on a short visit to London.

ROBERT H. RICHARDS and FRANK E. SHEPARD are visiting the Washoe smelter, at Anaconda, Montana.

S. J. SPEAK, of the firm of Hooper & Speak, London, has left for Siberia on a professional engagement.

WILLIAM M. BREWER is examining prospects on the Queen Charlotte Islands, off the coast of British Columbia.

WILLIAM M. FITZHUGH has been investigating the dredging operations on the Yuba; he goes to Colombia shortly.

M. B. RAPP is superintendent for the Franklin Mining Co., operating a lease on the Gold Sovereign mine, Cripple Creek.

GERALD M. BROWNE, of the firm of Pearse, Kingston & Browne, London, has left for Siberia to inspect the Kluchi gold mines.

J. M. CALLOW has just returned to Salt Lake City from Telluride, Colorado, where he was directing work at the Tomboy mill.

W. C. WYNKOOP, whose office is now in the Merchants Exchange Bdg., San Francisco, has gone to Colorado on professional work.

LOUIS C. MAYER and HOWARD W. HOLMES, mining and civil engineers, are now associated, with offices at 624 Santa Marina Bdg., San Francisco.

W. L. STEVENS, superintendent for the Tennessee Copper Co., has been with W. H. Weed, examining the La Dicha mines, in Guerrero, Mexico.

D'ARCY WEATHERBE crossed the Andes from Catamarca in the Argentine, to Chile, and then returned to Buenos Ayres. He will sail for London on February 18.

ENGLE CARPENTER and JOHN C. BRENNON, of the Benito Juarez Mines Co., City of Mexico, have been at Chicago closing contracts for machinery for the various properties they direct in Mexico.

RICHARD S. MCCAFFERY has resigned as manager for the Salt Lake Copper Co. and has accepted the position of superintendent and metallurgist for the Tintic Smelting Co., now building a smelter.

E. R. RYAN, formerly assistant general manager of the Guanajuato Development Co., has joined the firm of Carpenter & Brennon, mining engineers, of the City of Mexico, and the firm will be known as Carpenter, Brennon & Ryan.

The firm of STEINHART, VOGEL & CLOUD, consulting engineers and metallurgists, London, has been dissolved by mutual consent. T. C. Cloud continues to practise as a specialist in copper smelting. He is consulting metallurgist to Elliotts Metal Co. in South Wales. J. F. L. Vogel is taking up the management of a tungsten works in the north of England. O. J. Steinhart resumes practice as a consulting metallurgical engineer.

Only one of the rope shops of the JNO A. ROEBLING'S SONS CO. was destroyed in the recent fire at Trenton, N. J. All orders will be promptly filled from the large stocks on hand in their warehouses at Los Angeles, San Francisco, Portland, and Seattle.

Latest Market Reports.

LOCAL METAL PRICES—Feb. 6.

Antimony	12@16c	Quicksilver (flask)	$45@45.50
Casting Copper	17½@18⅛c	Spelter	6½@ 7¼c
Pig Lead	4.10@ 5.05c	Tin	33@34½c

ANGLO-AMERICAN SHARES.

Cabled from London.

	Jan. 30. £. s. d.	Feb. 6. £. s. d.
Camp Bird	0 16 3	0 16 0
El Oro	1 0 7½	1 0 7½
Esperanza	1 5 0 ex div.	1 2 6
Dolores	1 8 9	1 8 9
Oroville Dredging	0 12 3	0 12 6
Stratton's Independence	0 3 9	0 2 9
Tomboy	1 8 9	1 7 6

(By courtesy of W. P. Bonbright & Co., 24 Broad St., New York.)

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date	Electrolytic Copper	Lead	Spelter	Silver
Jan. 31	13⅝	3.73	4.58	55¼
Feb. 1	13⅝	3.73	4.63	55½
" 2	Sunday.	No market.		
" 3	13⅝	3.73	4.63	55½
" 4	13⅝	3.73	4.68	55½
" 5	13½	3.73	4.68	55¼
" 6	13½	3.73	4.73	55⅝

SOUTHERN NEVADA STOCKS.

San Francisco, Feb. 6.

Atlanta	$ 38	Laguna	
Belmont	1.72½	Manhattan Con	21
Columbia Mtn	23	Midway	80
Combination Fraction	81	Mizpah Extension	8
Daisy	1.07½	Mohawk	10.00
Fairview Eagle	75	Montana Tonopah	1.95
Florence	1.65	Nevada Hills	3.25
Gold Bar (Bullfrog)	37	Red Top	
Goldfield Con	5.10	Sandstorm	29
Goldfield of Nevada		Silver Pick	32
Gold Kewanas	51	St. Ives	19
Great Bend	40	Tonopah Extension	1.40
Jim Butler	11	Tonopah of Nevada	5.30
Jumbo		Tramp Con	30
Jumbo Extension	51	West End	39

(By courtesy of W. C. Ralston, 353 Bush St.)

COPPER SHARES—BOSTON.

	Closing prices. Feb. 6.		Closing prices Feb. 6
Adventure	2	Michigan	11
Ahmeek	60	Mohawk	53
Allouez	20	Nevada Con	10
Amalgamated	69⅜	North Butte	48⅛
Areadian	4⅜	Old Dominion	37⅛
Atlantic	11½	Osceola	80
Balaklala	2⅞	Parrot	14
Bingham Con	50⅛	Phoenix	1
Boston Con	14⅞	Quincy	85
Butte Coalition	18⅛	Raven	
Calumet & Arizona	110½	Rhode Island	3⅞
Calumet & Hecla		Santa Fe	2⅛
Centennial	23	Shannon	12
Con. Mercur	25	Superior & Pittsburg	13⅛
Copper Range	62⅛	Tamarack	65
Daly-West	8⅛	Trinity	14⅛
Franklin	8¾	United Copper com	6⅛
Granby	85	Utah Copper	26
Greene-Cananea, ctf	8½	Victoria	1
Isle Royale	23½	Winona	6⅛
Mass	3	Wolverine	125

Dividends.

On February 1, the Bunker Hill & Sullivan Mining & Concentrating Co. paid dividend No. 125 of $60,000. This makes the amount of dividends paid since January 1, $120,000, and the total to date $9,936,000.

General Mining News.

ALASKA.

Advices from Fairbanks indicate that the strike which was ordered by the local miners union for Feb. 1 has been a dismal failure; the few men that went out were quickly replaced. Many of the members of the union condemn the officers for calling the strike, saying they won their point when the operators agreed to the scale of $5 for an 8-hr. day, with board and lodging. Now the operators have established a card system which gives assurance of work, prompt payment of wages and sick benefits, but bars union men from obtaining employment in the mines. Although many men are arriving over the trail and finding employment, the operators issued a statement on Feb. 4 saying that they would give employment to 1500 men more than they had at that date. The outlook now is that the Tanana district, with its labor troubles settled, may produce $15,000,000 this season.

ARIZONA.

COCHISE COUNTY.

(Special Correspondence).—The operations of the Tombstone Consolidated Mines Co., at Tombstone, are centred at two main shafts, the main pump-shaft and the Emerald. The former is now 1000 ft. deep, and the pumps installed therein are raising to the surface 4,700,000 gal. of water every 24 hr. In addition to the present pumping force the company has ordered and will soon install at the 1000-ft. station two Prescott pumps, each of 1200-gal. capacity per min. A lift of 1000 ft. will be made with these pumps. This combined pumping force, it is anticipated, will keep the lower workings all over the district reasonably free from water. At the Emerald shaft, which is 900 ft. deep, a winze has been sunk from the 900-ft. level, which opened a body of ore running well in chalcocite, silver, and gold. This discovery at the depth mentioned is considered of importance to the district. Sinking in this winze continues with the purpose of reaching 1100 ft., which corresponds to the 800-ft. level in the main pump shaft. The bulk of the ore being mined and milled comes from the 600-ft. level and levels above it in the pump shaft. These ores are largely oxidized, quite silicious, carrying 0.13 oz. gold, 6.6 oz. silver per ton, and considerable lead. The sulphides come in below the 600-ft. level. The 40-stamp mill handles 200 tons of ore per day, the pulp from the batteries passing to tables from which there is a product of one ton of concentrate from 60 tons of ore. This product contains lead, silver, and gold and is worth $200 to $300 per ton. It is shipped to the El Paso smelter. The table tailing and middling pass to hydraulic sizers for separating the sand from the slime, Callow tanks being used as pulp thickeners. The sand and slime materials are cyanided separately. Shipments of about 15 carloads of crude ore per month are made from the Emerald mine, carrying silver, lead, and gold. A strike of rich silver-lead and gold ore in the old Lucky Cuss mine, belonging to the same company, was made some time ago at 170 ft. below the old water-level. This includes horn-silver and native silver. This company uses oil as fuel under the boilers, which the superintendent, E. W. Walker, states is more economical than coal for this property. W. F. Staunton, general manager for the company, spends a part of his time at the property of the Imperial Copper Co., at Silverbell, where a one-furnace copper smelter, with copper converters, is now ready to be set in operation.

Tombstone, Jan. 31.

(Special Correspondence).—Bisbee is rapidly recovering from the financial depression.——On Jan. 29, the Copper Queen and Calumet & Arizona companies each blew in one more furnace at Douglas; this makes seven out of nine furnaces of the first company and all five of the Calumet & Arizona furnaces that are now in operation. When the production was curtailed last December only six of the Copper Queen and three of the Calumet & Arizona furnaces were kept running. The monthly production of the camp is now about 12,000,000 lb. of copper, of which the Calumet & Arizona is making about 3,000,000 lb., the Superior & Pittsburg 2,000,000 lb., and the balance is made by the Copper Queen Co.——Underground development is going steadily ahead; it is safe to say that never in the history of the camp has so much ore been developed in any one mine in the same time. Probably the most important development during the last month was on the 1200-ft. level of the Hoatson mine of the Superior & Pittsburg Copper Co. Here a body of good-grade ore was exposed for 200 ft. in one direction; as it carries much iron oxide it is valuable as flux. The Hoatson shaft is down over 100 ft. below this level, and as soon as sufficient depth for a slump has been gained, the 1300-ft. level will be opened.——In the Oliver mine of the Calumet & Arizona company a large quantity of sulphide ore has been developed on the 1250-ft. level.——The Copper Queen company is going steadily ahead with its work at the Sacramento shaft; eventually all the ore from the mines will be hoisted through this shaft. Long drifts are being driven from the shaft to the various mines; electric haulage will be used.——At present the Shattuck & Arizona company is doing very little work. The Denn Mining Co. is boring a diamond-drill hole. B. M. Pattison has resigned as general manager of this and the Shattuck & Arizona company, and as yet no successor has been named, although it is rumored that S. A. Parnall will be appointed.——The trolley line from Warren to the mines has been completed.

Bisbee, Jan. 31.

F. C. Dezendorf and L. G. Gillett, agents of the United States Land Office, are looking into the character of the ground in the Bisbee district which has been taken up under mineral application, and concerning which there is some question.

GILA COUNTY.

The Superior & Boston company has made its first shipment to the Old Dominion smelter, the consignment consisting of two carloads of 8% copper ore from the Limestone shaft.——From the Gray mine of the United Globe company about 100 tons of ore are shipped daily to the smelter by way of the Arizona Commercial railroad, instead of the former horse transportation system.——The Independence mine is furnishing the Old Dominion smelter 15 to 20 tons of sulphide ore daily; the smelting company will furnish additional teams to double the shipments.——Good lump sulphide ore is being shipped from the Continental mine; 25 men are employed.——Ore from the Gibson mine is arriving at the Old Dominion smelter at the rate of about 25 tons daily.——At the Black Hawk mine in sinking a winze the ore has increased in copper content from 7% at first to 14% at a depth of 45 ft.; the ore contains malachite and a small quantity of chalcocite.——The raise from the Black Oxide adit is 100 ft. long, and driving horizontally on the vein will soon be commenced.——The Buffalo Hill mine is being explored on the 10th level by the Old Dominion company; a cross-cut has passed through several veins and it is expected that it will soon cut the Maggie vein.——At the Old Dominion mine, the water problem in C shaft has been disposed of satisfactorily; connection with the 9th level will soon be made. In the western part of the mine a cross-cut is being driven on the 15th level. On the 16th level, 30 tons of sulphide ore carrying 3 to 5% copper are being extracted daily.

GRAHAM COUNTY.

Excitement has been created in Safford by an assay of ore from the Graham mountains; J. C. and William Robinson, the discoverers of the lode, claim that it is 17 ft. wide, and that the sample, which carried at the rate of $460 gold per ton, was taken across the vein.——Walter Doudna has let a contract to W. S. Riley to drive a 75-ft. adit at the Gypsy mine.——At the New York-Arizona mine development work continues to expose a fair-grade milling ore.——The New England company has completed the shipment of the Copper King ore that had been stored in North Clifton. Quite a number of carloads of ore are being

shipped from the Antietam mine.——At the Gold Belt mine gold ore of good quality has been found at a depth of 265 ft. in the shaft.

PINAL COUNTY.

A story comes from Phoenix that a certain mine situated within 1000 ft. of the Two Queens mine and owned by H. B. St. Clair, H. H. McNeil, and others, yields a particularly choice variety of gold, known as emerald green or Roman gold; it is said to be used mainly by manufacturing jewelers for rings and other jewelry in which emeralds or diamonds are set. It is alleged that John Kavanaugh of Troy bought some of it from the former owners of the property and had a ring made of it; this ring when placed beside an ordinary gold ring appears to have a decidedly greenish tint. The property is developed by a 70-ft. shaft and a 40-ft. adit. A small force of men is to be put at work searching for more green gold.

YAVAPAI COUNTY.

(Special Correspondence).—W. H. Reiterman, secretary and manager for the Money Metals Mining Co., operating in the Big Bug district and also in the Black hills, reports development work progressing rapidly on the Big Bug property known as the Bordeaux group of claims. The work has been advanced 200 ft. in a drift on the 100-ft. level. The work of sinking in the main shaft is also being pushed, and a depth of about 165 ft. has been attained. About 300 tons of ore carrying gold, silver, lead, and copper (principally gold) have been taken out in development work, no stoping being done. This ore has been concentrated at the Arizona M. & M. Co.'s mill, which is situated about 1½ miles below the Bordeaux mine. The concentrate carries approximately $102 gold and 9 oz. silver per ton, and 31% lead. The concentrate will be shipped in a short time to Needles, Cal., for final treatment.——Considerable development work is being done in the Copper Basin district, a number of properties being worked under bond and lease.——That interest in mining has not diminished in Yavapai county is evidenced by the large number of locations and affidavits of assessment work that are daily being filed with the County Recorder.

Prescott, Jan. 31.

At the Savoy mine, in the Bradshaw mountains, the retimbering of the adit is in progress.——E. A. Haggott is preparing to resume work at the Howell group of mines in the Santa Maria district.——The Redman M. & M. Co. has ordered an air-compressor and air-drills, which are to be delivered at the mine at once.——The Hydraulic Gold Mining Co. has taken over the placer mines of the Messicks estate on Lynx creek and has placed an order for machinery to handle 1000 cu. yd. of gravel per day.——Two companies are now operating machines on the San Domingo placers; it is expected that 10 machines will be in operation shortly.

YUMA COUNTY.

It is reported that eastern people are organizing a company to work the silver mine of J. C. Reed in the Harqua Hala mountains.——R. K. Humphrey and Charles H. Fay intend to begin work at once on the Rattlesnake and Extension claims, which adjoin the North Star property; the ore on the Rattlesnake claim is said to carry $10 per ton.——Supplies are being hauled to the property of the Great Western Mines Co. in the Bill Williams Fork district.

CALIFORNIA.

BUTTE COUNTY.

A depth of 35 ft. was reached in the first three days' work of the drill at the diamond mine. Slow progress was made at first owing to cemented gravel, but later the drill was working in sandstone and good progress was being made. Visitors in searching at the dump of the main shaft on the property have found a number of stones closely allied to diamonds.

CALAVERAS COUNTY.

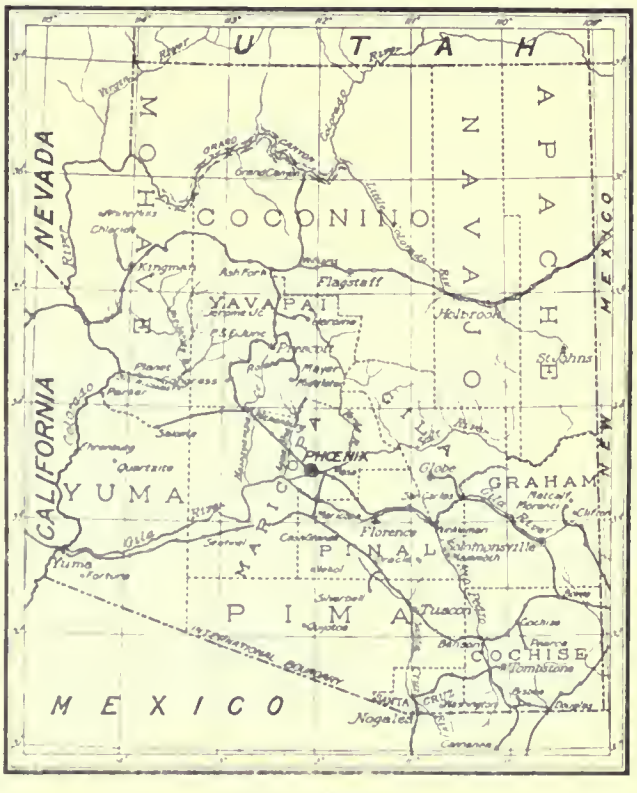
The Lightner Mining Co. has 60 stamps crushing ore; the ore can be mined, milled, and chlorinated for the sum of $2 per ton.——The Utica mine is starting up again after five months' shut-down on account of a strike, three months spent in unwatering the mine, and a month of delay caused by an accident in the shaft.——At the Angels mill 20 stamps are dropping.

EL DORADO COUNTY.

Work has been resumed at the Jones Hill mine in the Georgetown district; W. S. Kerr is superintendent.——The Warner ranch has been purchased by Koster & Berff for mining purposes.——Pipe is being hauled to the California Mohawk mine in the Fairplay district; the restraining dams are nearly completed.——B. F. Hartley, the superintendent of the Three Stars mine in Placer county will have charge of the Zantgraf mine.

INYO COUNTY.

A 600-ft. adit is being driven under contract at the Skookum mine near Benton; C. T. Julihn is superintendent.——A contract has been let for the Keeler-Skidoo road.——Chicago capitalists have purchased a property in Pleasant canyon near Ballarat; they intend to begin development soon.——It is reported that at Anvil Springs a strike



Map of Arizona.

of considerable importance was made recently by a Mr. Rush, who claims to have a vein 14 in. wide of ore assaying $275 gold per ton; the ore is being sacked for shipment by way of Johannesburg.

NEVADA COUNTY.

The new adit at the Belle Union mine is now 175 ft. long.——At the Normandie mine on Deadman's Flat men are getting the machinery in shape for sinking a shaft. A new steam hoist and pumping plant have been installed; the plant is to be operated with oil as fuel.——On the 1000-ft. level of the Murchie mine the west drift of 500 ft. exposes a vein that averages 4 ft. wide. About March 1 sinking will be resumed and later a level will be opened at the depth of 1100 ft.; 50 men are working on the property and the 20-stamp mill is crushing good ore.——At the Conlan mine the adit which is being driven to cut the vein at depth is expected soon to break into high-grade milling ore. In the old shaft some ore assaying as high as $23 per ton has been found, but it does not mill freely; H. G. A. Brunnier is general manager.——J. F. Littlefield has purchased the Fish Pond placer property, which extends for 5000 ft. along Greenhorn creek below Quaker Hill; it is reported that he intends to dredge it.——A body of high-grade milling ore has been found in the west drift of the Union Hill mine; Clifford Graham is manager.

PLUMAS COUNTY.

Frank Sorsoli, Edward Abbott, and Frank Spring have made another payment on the Halstead mining property, 8 miles from Spanish Ranch; the lode is supposed to be in places 60 ft. wide and to carry $1 to $20 gold per ton, besides 2% of sulphides which upon being concentrated assay as high as $2800 per ton. The lode is developed by a series of adits.

SAN BERNARDINO COUNTY.

The development of the new camp at Hart continues; excitement is running high. Thirty-five leases have been let and 200 men were expected to begin work Feb. 1. Foster Bros. in their cross-cut on the Oro Belle mine have found a small orebody a foot wide that is said to carry at least $1000 per ton; a burro train is packing it in sacks down to the office. Specimens covered with gold will assay at the rate of $10,000 per ton.——At the Todhunter, Felix, and Aldrich leases ore fairly covered with gold is being taken out in small quantities.——Hart & Hitt are sacking ore from the original discovery and the Oro, Lee Foster, and Goldfield Big Chief companies are shipping ore.——A contract has been let for the daily delivery of 8000 gal. of water into the town of Hart; the pipes for the water-line are at Barnwell.

SHASTA COUNTY.

Two months ago F. M. Leland purchased the Washington mine near French Gulch; he has given the mill and other machinery a thorough overhauling, has put in new plates and two new concentrators, and is building new boarding and bunk houses. There are 25 men employed at present.——The Sacramento Valley & Eastern railroad is completed as far as Horse creek and will reach Delamar in a short time.——The electric iron smelter at Heroult started again on Jan. 29. When started three weeks ago the walls of the furnace showed signs of cracking open and certain improvements were found necessary.

SIERRA COUNTY.

H. L. Johnson has resumed work in the lower adit of the El Dorado mine.——At the Tightner mine the lower adit is being driven rapidly; a flow of water recently rendered it difficult to spit the fuses, this water draining from the old shaft, which is now dry.——The Rainbow mill is running steadily on high-grade ore; 20 men are employed in the mine and mill.——At the Red Star mine reopening the old adits is rapidly advancing; about 1400 ft. has been completed. Ed Brindle is superintendent.——The Alleghany Mining Co. is operating its hydraulic mine at Chipps Flat under a permit issued by the United States Debris Commission.——At the Plumbago mine a modern lodging house has been built; it includes bath-rooms and electric lights. M. W. Mather is superintendent.——At the Deep Blue gravel mine, just below Alleghany a force of men is developing the quartz vein recently discovered there; the high-grade ore is being hauled to the El Dorado mill; S. M. Weiland is superintendent.

SISKIYOU COUNTY.

Last fall W. C. Stanley and L. F. Coburn bought a gold prospect near Hawkinsville, erected a 2-stamp mill, and in 20 days took out about $2500, the ore milling nearly $28 gold per ton. About 20% of the gold content goes into the concentrate. The owners are trying to raise money for additional equipment and development.——Nickel ore is reported to have been found at the base of Mt. Shasta, about two miles from Sisson.

TUOLUMNE COUNTY.

The repairs on the Calmas mill at Tuttletown being finished, 10 stamps are now dropping on ore from the 100-ft. level of the Calmas mine.——Conlin Bros. have men at work replacing the pipe-line from the Tuolumne water-ditch to their Experimental Gulch mine; the new pipe is 8-in. diam. and will be 3000 ft. long. Thirty tons of ore from the Sullivan Ranch mine crushed at the Santa Ysabel mill for J. W. McGinn is reported to have yielded about $13 per ton.——J. T. Thompson and F. E. Drew have been arrested on the charge of stealing amalgam at the Smith mine near Columbia and at the Clio mine near Jacksonville. In their baggage there was found a tobacco sack filled with amalgam, and also tools which may have been used in robbing the plates.——H. M. Stanley has shipped 200 lb. of ore from No. 9 mine, at Groveland, to San Jose to be tested.——John Vincent and W. D. Mullins are said to have a splendid prospect on a 'pocket' claim located on the Vincent ranch near Tuttletown.

COLORADO.

CLEAR CREEK COUNTY.

Great interest was manifest throughout the upper Clear Creek district when the announcement was made that the new mill of the Empire Gold M., M. & T. Co. was to be put into commission. This is the first time in the history of mining in the northern Colorado mining region that the Hatheway gyratory mill has been tried, and naturally owners of mines in the sulphide belt of the upper Clear Creek district were interested.——At the Nabob mine on Columbian mountain, at a distance of 250 ft. from the entrance of the adit started a few weeks ago, a streak of high-grade silver-lead ore, 6 to 8 in. wide, has been exposed. The work under way is being performed by Lovell, Taylor & Co.——A shipment of several tons of ore from the Riley lease on the Sunburst mine returned 505 oz. silver per ton. ——At the Centennial mine, stoping is in progress on an orebody 10 to 16 in. wide that carries $35 in gold and copper per ton.——Machine-drills having been brought into use by the Marshall-Russell Gold M., M. & T. Co. at its mine near Miller mountain, the adit is being driven steadily ahead; it is now over 1100 ft. long.

SUMMIT COUNTY.

The American Zinc Extraction Co. has agreed to buy the Little Sallie Barker group of six claims in the Bevan district from A. W. Phillips and T. A. Brown for $20,000; part of the purchase price has been paid.——There is only one shift working at the Daly Judge mill, but a good output is being maintained from the mine.——In the shaft-house of the New York Bonanza mine a lot of first-class ore is being sacked for shipment.

TELLER COUNTY.

(Special Correspondence).—Work is progressing as rapidly as possible on the Cripple Creek drainage adit. Beginning today A. E. Carlton will have charge of the work under contract. So far about 1400 ft. has been driven, or on an average of about 200 ft. per month. Wm. Bainbridge has charge of the work and T. R. Countryman is engineer. ——The W. P. H. Leasing Co. has made a successful run on Jerry Johnson dump ore and are temporarily closed down for some changes and installing new machinery to handle the material as it is brought to the mill. A hoist and car system is being installed. Only 50 tons per day is going through the mill at present but this is to be increased to 100 tons shortly. W. A. Reed is manager.——Thos. Kavanaugh is handling ore from the Ramona mine through the Wild Horse mill. The ore averages about $3 per ton and 95% is saved by cyaniding 50 tons per day, without roasting. The Ironclad mill, better known as the Little Homestake, is handling 100 tons per day of $1.80 to $2 ore, saving 85%. To mine and put in the mill costs 30c. per ton and milling costs 80c. per ton. Another vat has recently been installed; this will increase the capacity to 120 tons per day. B. H. Liener is manager and C. E. Hart superintendent of mill.

Cripple Creek, Feb. 1.

The production from the Cripple Creek district for January broke all records for 31 days during the past three years; the total ore handled amounted to 58,785 tons, of a gross value of $1,335,820. The Golden Cycle mill at Colorado City handled 20,300 tons, and the U. S. R. & R. Co. 17,500 tons.——Now that the workings on the 1000-ft. level of the Gold Coin mine have been drained, the management will commence stoping the high-grade ore that was developed before the workings were drowned out several months ago. Although of small size, the orebody is extremely rich and contains a narrow streak of sylvanite ore that

carries 20 to 50 oz. gold per ton.——W. J. Hill and associates, lessees at the Pharmacist and Wrockloff claims on Bull hill, have made a settlement with the operators of the Golden Cycle mill on two consignments of ore sent recently; one lot of 20 tons returned $118.70 per ton and another lot of 47 tons returned $29.30 per ton.——McBride and associates, lessees at the Morning Glory mine on Raven hill, made a 20-ton shipment of medium-grade ore to a local sampler.——Merrifield & Co. have begun operations on the old Pike's Peak claim adjoining the Lucky Gus No. 2 claim on Bull hill; they will drive a cross-cut on the 300-ft. level east of the shaft.——The Rigi claim of the Rigi Group Gold Mining Co. on Battle mountain is the scene of the latest strike of particular importance to the Cripple Creek district generally. An ore-shoot was opened by lessees three weeks ago, but only two shipments of medium grade ore were made from the property. The vein is from 1 to 4½ ft. wide and carries 1½ to 3 oz. gold per ton.

NEVADA.

ESMERALDA COUNTY.

Governor Sparks signed the Nevada police bill on Jan. 28. It is expected that the police force can be organized and made ready for business in 20 days. It is said that Captain W. L. Cox, of Reno, is to receive the appointment of superintendent; he has the military experience necessary for the place. The withdrawal of the card system by the Goldfield Mine Operators Association does not affect the original policy of the operators in the employment of union or non-union miners, for although under the open-shop plan, the only recommendation a miner needs to secure employment is proof of his competency and reliability; the agitators of the Western Federation of Miners would be unable to furnish such proof and hence could not secure work. Apparently the domination of the Western Federation is a thing of the past in the Goldfield district, as the union will receive no recognition whatever from the operators.

The Consolidated and Florence companies will not hurry to put on a big force of men. Nothing will be done on company account in the way of mining at the Florence mine until the new mill is ready to work. No effort will be made for a big production at the Consolidated property until the new model reduction plant is completed next fall, as railway and smelter charges are too high.——Work at the Oro mine was to be started on Feb. 5, with the intention of sinking the shaft to a depth of 500 ft.——A small force of men has been cleaning drifts on the Florence Leasing & Mining Co.'s ground.——The Garrett lessees at the Kendall mine have taken a lease on the Kinkead mill to treat the low-grade ore which has accumulated on the dump; at the Garrett lease there are also large bodies of milling ore blocked out that will keep the mill running to full capacity for many months.——The first shipment of ore from Stimler consisted of 10 tons from the Watson-Irvine mine.——The Rawhide Regent company has a small force of men driving a 50-ft. adit to cross-cut its vein on the south side of Nil Desperandum peak; G. T. Milliner is general manager.——The Wild West lease being operated by the Grutt Bros. continues to yield specimen ore of great richness from a vein 18 in. wide.——At the Butler-Hunt lease on Balloon hill, Harry Butler while prospecting on the surface found some rock that assayed well.——Cotter, Conners, McGettrict & Marshall have found on the Luning lease a body of ore containing a 1-in. streak that assayed over $19,000 gold per ton; this has been followed to a depth of 35 ft. and found to perceptibly widen.——Shipping ore is piling up at the workings of the old Loftus & Davis lease on the Sandstorm mine, which is now being operated by M. C. Scully.——Ore carrying $15 to $40 per ton is exposed on the 150-ft. level of the Blue Quartz mine.——At the Quartzite Annex mine, the working shaft is being sunk from the 75-ft. to the 300-ft. level.

LYON COUNTY.

It is stated that J. H. Hill is making arrangements to dredge the Carson river for the millions of dollars worth of amalgam that is supposed to lie along the bottom of the stream.——Preparations are in progress for an early resumption of work at the Western Nevada copper mine.——It is announced that the owners of the Nevada-Douglas and Ludwig mines are planning the construction of a smelter and of a railroad from the mines to Wabusca.——Another rich strike of gold ore is reported from Mountain View; the Mason Valley Mining & Leasing Co. has found on the Big Twenty claim a 1-ft. vein of ore that is said to carry $128 gold per ton. This ore is being sacked for shipment.——Fred Flindt has secured a small bar of bullion by milling ore from the Wheeler mine.——At the McConnell mine 17 more miners were recently engaged.

NYE COUNTY.

The total output of the Tonopah mines for the week ending Jan. 31 was 3921 tons, of an estimated value (the shipping ore being valued at $60 per ton and the milling ore at $20 per ton) of $82,060.——The Belmont mill was closed down for two days during the week, to make connection with the Nevada California Power Co., whose power it will use from now on. The amount of ore handled by the mill was on that account somewhat curtailed. Work is progressing systematically on the different levels of the Belmont mine; on the Occidental claim a body of ore 3 to 3½ ft. wide has been found in the South vein.——Six machine-drills are at work in the Jim Butler mine and work is progressing on all the levels.——A test run of 100 tons of ore is being crushed by the Yellow Jacket mill

New Hotel at Goldfield.

at Gold Hill.——The Round Mountain Hydraulic Gold Mining Co. cleaned up between $7000 and $10,000 on Jan. 22. The directors of the company have decided to purchase $20,000 worth of pipe to complete the Jefferson Canyon system of conduits.——The Manhattan Milling & Leasing Co. is erecting a 2-stamp mill on the Buckboard claim in close proximity to some of the rich leases on Litigation hill; this will be Manhattan's fourth mill.——There is a story that a new free gold district has been found in the northern part of the county, near the mouths of Becker and Barrett canyons on the north side of the Reese River valley, about forty miles southwest of Austin. It is said that several veins from 5 to 25 ft. wide, carrying $15 to $200 per ton, have been opened, and that many stringers from 1 to 5 in. wide carry $100 to $4000 per ton. On the Lost Treasure group of claims there is said to be a 25-ft. vein that carries an average of $20 per ton. The Peterson Bros., it is alleged, recently secured $8800 by mortaring in a single week.——A body of ore 10 ft. wide has been cut in a cross-cut on the 300-ft. level of the Denver mine of the Tramp Consolidated Co. at Rhyolite. A Blake crusher and a 200-ton cyanide plant will be installed for the Bullfrog Pioneer Leasing & Milling Co.; in the mine there is sufficient ore in reserve to keep the plant in operation for many months.——Supplies and men have been taken to the Keane Wonder Extension mine to start devel-

opment work.——The annual report of the Tecopa Consolidated company shows that the ore shipments from August to Jan. 1 amounted to 7453 tons, which yielded $113,667 over and above smelting and transportation charges. The cost of mining averages $2 per ton; the ore being shipped carries about $25 per ton.

Stoping for ore is progressing as usual at the Tonopah Extension mine; good progress is being made in the north cross-cut on the 1050-ft. level.——At the MacNamara mine the working force has recently been increased. A raise has been driven up 80 ft. in high-grade ore.——The adit of the Round Mountain Monster Mining Co. has cut a series of veins that are from 3 to 5 in. thick and are said to be high-grade tungsten ore.——At the Sunnyside mine the vein has been cut in the shaft at the 350-ft. level; this adds much to the ore reserves.——At the Sphinx mine a Huntingdon mill and boiler have arrived from Austin and the erection of the mill is now in progress.——The conflict between the Manhattan Earl Mining Co. and the Manhattan Consolidated Union No. 2 Co. has been satisfactorily adjusted; the former company gets the disputed territory. ——The Montgomery-Shoshone mill at Beatty is treating 200 tons of ore per day; the output is estimated at $75,000 per month.——A carload of ore has been shipped from the Diamond Queen mine; this ore is said to have carried over $200 gold per ton.

WHITE PINE COUNTY.

(Special Correspondence).—The Boston-Ely Development Co. about fifteen months ago acquired a group of claims comprising approximately 180 acres adjoining the Cumberland-Ely holdings on the west. This part of the Cumberland-Ely property was formerly the Veteran-Ely ground. In the Veteran mine there is blocked out an immense tonnage of what is said to be the highest grade sulphide copper ore in the district. The orebody is very persistent in a westerly and northwesterly course, but the oxide zone becomes deeper in that direction, so that the lowest drift ran out of and apparently over the ore, which dips westerly at a rather steep angle. In Boston-Ely ground the porphyry plunges beneath the limestone. The company has penetrated the limestone with churn-drills and ran down through 400 ft. of porphyry, but did not get through the oxidized zone. A shaft being sunk 300 ft. north of the point at which the drilling was done is 650 ft. deep and has not reached the base of the limestone. In a cross-cut which was driven north on the 600 ft. level a fractured zone was found to carry a small quantity of the precious metals. This vein matter strikes toward the Veteran orebody and may be an offshoot from the main porphyry belt. The company was recently re-organized and is now known as the Boston-Ely Mining Co. The shares of the company have risen from 60c. to $3.65 in the last three days.

Kimberly, Jan. 17.

The announcement has been made that the Nevada Consolidated Copper Co. has decided to issue bonds in the sum of $2,000,000; they will bear 6% interest and will be convertible at the option of the holder to stock of the company at the rate of $10 per share. This will furnish money for the completion of the reduction plant at McGill. W. A. Perkins, general superintendent of construction work at McGill, engaged 500 men in Salt Lake City to assist in the early completion of the plant.——P. H. Cannon and others have conveyed the Flagstaff mine near Cherry Creek to the Cherry Creek Mines Co. for a stock consideration.

WASHINGTON.

FERRY COUNTY.

(Special Correspondence).—The fifth carload of ore has been shipped by the lessee of the Insurgent mine. Five men have been employed on the lease, but work was suspended six weeks because the smelters could not take the ore; since resuming work the five men took out four carloads of ore in four weeks, two of which were side-tracked on the railway until W. M. Crummer, the lessee, induced the Granby smelter manager to accept them. The other two carloads are in transit, the estimated average value of the last one shipped, from a bunch of ore on the foot-wall, being nearly $100 per ton. The Insurgent mine is located on the eastern extension of the Lone Pine vein, and the lessee has the privilege of working it through the lower adit of the Lone Pine workings.——The Syndicated Deep Mines Co. has a small force of men overhauling the machinery of the Pearl Consolidated Mining Co. on the Lone Pine claim and expects to begin pumping the water out of the shaft about Feb. 4.——At the annual stockholders' meeting of the Oversight M. & M. Co., held at Republic Jan 25, the following directors were elected: Harold Preston, E. M. Carr, Wm. Martin, C. A. Wallace, Chas. E. Murphy, E. J. Delbridge, and S. G. Dewsnap.——The machinery at the Copper Key mine is now in splendid condition, and the compressor is furnishing all the air that is needed to run two machine-drills. The adit is now 269 ft. long.—— The Colville M. & S. Co. is arranging to haul two rotary furnaces to its South Half group of claims at Park City on sleds, while sleighing is good.——The adit lately started on the Dominion group of claims, in Keller district, is in 60 ft. and gaining a foot per day.

Republic, Jan. 31.

OKANOGAN COUNTY.

(Special Correspondence).—At the Unga mine near Wauconda the lower adit is being driven to cut the vein. The management reports having struck good ore in the shaft. ——A large body of valuable ore has been uncovered in the Gold Dust mine, adjoining the Bodie mine, and the company anticipates making a shipment in a week or two.—— The Gold Creek Antimony Mines & Smelter Co. of Wichita, Kansas, operating a valuable antimony mine in the Twisp district, has ordered seven carloads of machinery for its mine and mill.——The Hidden Treasure mill at Twisp has resumed running, after being closed down for several weeks. The company's mine has been operated continually with two shifts; ore is being hauled to the mill on sleds. ——A 2-hp. gasoline engine and small air-compressor have been installed at the Alder mine, to be used for forcing air to the head of a 500-ft. adit, where two shifts of men are at work.

Republic, Jan. 22.

CANADA.

BRITISH COLUMBIA.

The ore shipped from and crushed at the mines of the Rossland district for the week ending Jan. 25 was as follows: Centre Star, 3610 tons; Le Roi, 1540; Le Roi No. 2, 630; Evening Star, 70; total, 5850 tons. At the smelter of the Consolidated company at Trail there was received during the week 4941 tons of ore. Besides that from Rossland mines, shipments were received from other mines as follows: St. Eugene, 351 tons; La Plata, 133; Emerald, 45; Sunset, 20; Arlington of Erie, 77; Evening Star, 27; North Star, 66; Vancouver, 42; Whitewater Deep, 48; New Jerusalem, 32; Richmond Eureka, 20; Bluebird, Sandon, 18; Eva, 56 tons. The following are the district shipments for the week: Boundary, 18,075 tons; Rossland, 5850; Slocan-Kootenay, 3029; Total, 26,954 tons.——A 20-hp. electric hoisting plant has been installed by the Greenwood City Waterworks Co. at the Tiptop mine in Skylark.——At the Rob Roy mine, on Wallace mountain, high-grade ore 18 in. wide has been found.——The Granby Consolidated M. & S. Co. has succeeded in getting its seventh furnace in blast. ——The superintendent of the Jewell mine at Long Lake is in Colorado, where he is investigating methods for the treatment of Jewell ore.——At the Crescent mine 10 men are driving on the 225-ft. level; it is likely that ore shipments to the Trail smelter will be resumed during this month.——Four carloads of ore have been shipped from the Emerald mine to the Trail smelter this year.

Work has been continued steadily during the winter at a number of copper mines in the White Horse district, including the Volerie, Arctic Chief, War Eagle, Empress of India, and Josephine.——The Tatlayoco Lake Copper Co. is driving an adit to develop a copper-bearing vein on its property about 150 miles north of Vancouver. Recently a gold and antimony-bearing vein was found on the same property; development of this will be begun in the spring.

Special Correspondence.

LONDON.

The Diamond Market.—Artificial Diamonds.—Depression in Kaffirs.—Dolores Limited.—Tin Ticketings.—Mining in Cornwall.—Market for Tin Ore.

The diamond share market continues to cause anxiety among shareholders and those interested in the trade. All sorts of rumors are afloat. It is even said that the Premier mine is to close down for a time, but this is emphatically contradicted. Rumor is also rife that there are difficulties which prevent an amicable arrangement between the De Beers and the Premier companies for the purpose of restricting production and maintaining prices. Those who control the trade will almost certainly be able to come to some agreement on this subject, and it is hardly likely that we shall see any cut in prices. I believe, however, that it is quite time that some reduction was made in the price of both uncut and cut diamonds. The price of a first-class diamond is higher now than it was before the great production commenced in South Africa. Twelve pounds per carat for small stones is far too much to have to pay, and a reduction would revive buying in many quarters. But, as I say, a reduction of output and not a reduction of price will almost certainly be the policy. The diamond market has had an element of comedy this week, in the action brought by Sir Julius Wernher in the French courts against Mr. Lemoine. The daily papers have naturally made the most of this incident and have decked out the story to suit the popular taste. The facts of the case are that some time ago Mr. Lemoine brought his alleged process for producing artificial diamonds before Sir Julius Wernher, who personally inspected the electric furnace in which the diamonds were made. Sir Julius asked Mr. Oats of the De Beers company to investigate, but as his report was unfavorable to the process, the matter dropped. Sir Julius had provided the inventor with considerable funds and this sum he was content to lose without publishing the matter to the whole world. However, when he found that Mr. Lemoine was proceeding with his work and conducting operations on a still larger scale, apparently with his (Sir Julius's) money, it was thought advisable to bring an action in the French court with the object of recovering some of the money, on the plea that it was obtained by false pretences. The outcome of the action is awaited with interest. The reason Sir Julius Wernher was induced to look into the invention was to see if the process was likely to interfere with the diamond mines. I believe as a matter of fact that Mr. Lemoine actually does produce tiny crystals, but he claims to produce big ones, which the prosecution allege to have come from Jagersfontein.

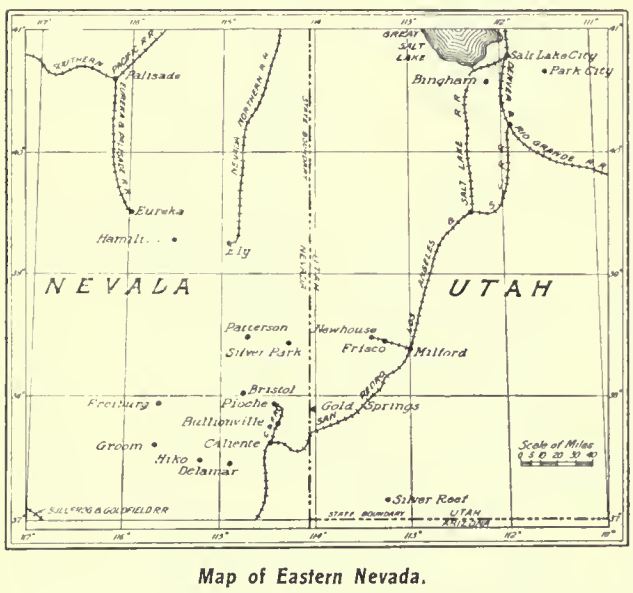
In spite of the record output of gold, particulars of which you have published, the South African market is far from lively. Naturally the diamond crisis affects other sections of the market. Then again we have had an issue of Cape of Good Hope colonial stock, and following this, Mr. J. B. Robinson is asking his shareholders to provide a million pounds more capital for the purpose of equipping the Randfontein group of mines. This issue has been somewhat sudden. Whether the money will be raised remains to be seen, but it is hardly likely that the response will be general. The Randfontein Estates Co. owns twelve mines, four of which are producing and the remaining eight sufficiently developed to warrant the erection of plant. It is intended to provide 600 stamps altogether and to work the mines in groups. The output of these stamps will be about 126,000 tons per month, and it is estimated that the profit will be about 10 shillings per ton. The new issue of shares consists of a million preference shares of participating certificates, entitling the holders to 6% preference dividend, and ranking equally with the ordinary shares as regards the balance of divisible profits. The issued capital originally, in 1889, when the company was formed, was £2,000,000. In 1899, 500,000 more shares were issued and in 1902 another 500,000 were disposed of, buying up the capital of £3,000,000. The issues of 1899 and 1902 were made at considerable premiums, the one-pound share being sold at £3. The present state of the money market can be well judged when this change from ordinary shares at a premium to participating certificates has had to be made.

It has been decided to wind up the English company called Dolores Limited and in future to place the entire management and control in the hands of the American company of similar name. It will be remembered that the English company was formed in 1904 by the Venture Corporation for the purpose of acquiring the shares in the American company registered under the laws of Maine and owning the Dolores mine in the Guerrero district of Chihuahua. The idea of the English flotation was to sell the shares in the English company in England, but for one reason or another the shares passed mostly into the hands of the Americans who were in control of the American company, and at the present time nine-tenths of the shares are held in America in this way. It is obvious that under the circumstances there was no argument in favor of maintaining the English organization; therefore, the company is to be wound up. It is a pity that this interesting and promising mine should have gone back to America.

The figures for the output of tin in Cornwall during 1907 are not available, but a very good idea of the output can be obtained by the amount of tin concentrates sold at the fortnightly tin ticketings. These ticketings are held at Redruth, where the five smelters bid for the various parcels offered by the mines. The total amount of concentrate sold in this way at the 26 ticketings in 1907 was 5720 tons and the price received by the mines was £593,704. During 1906 there were 27 ticketings and the amount sold was 5973 tons, realizing £626,780. Allowing for the difference in the number of ticketings, it will be seen that the output and average price per ton for the years were to all intents and purposes identical. The average price obtained for the concen-

trates at each ticketing during 1906 did not vary greatly and ranged from £97 to £114, without any violent fluctuations. During the first nine months of 1907 the prices obtained at the ticketings continued at a high level, never falling below £100 and for some months in the spring ranging from £115 to £120. After the end of September, the memorable collapse in the price of tin set in and the average prices at the last two ticketings in the year fell to £72 and £75. The future course of prices is none too promising.

It is a noteworthy fact that mines recently reopened or re-modeled have not yet redeemed their promise of increasing the output. The old stagers, like Dolcoath, Carn Brea, Basset, East Pool, Grenville, West Kitty, South Crofty, and Levant still constitute the backbone of the industry. Clitters only sold 125 tons of tin concentrate in 1907. Of



Map of Eastern Nevada.

all the recently re-opened mines, the Wheal Kitty in St. Agnes district has done the best and the credit for the good work is due to that sound and patriotic Cornishman, J. H. Collins. While younger men with modern ideas and plentiful supplies of capital at their backs are meeting with all sorts of difficulties that postpone the production of concentrate, Mr. Collins is regularly selling his six tons every fortnight, although he is short of working capital and uses old and so-called out-of-date machinery. As already mentioned, the total output of tin is not easily estimated, for the metallic contents of the concentrates sold cannot be actually ascertained. Perhaps three-quarters of the amount sold will average 66% tin. The remaining quarter consists of lower-grade concentrate and concentrate that contains metals subject to a penalty. In addition to the concentrate sold at the ticketings there are also products from the steam-tin works that are sold privately. These concentrates are not of high grade, and probably contain less than 50% metallic tin. The amount of concentrate produced in this way usually adds about 10% to the total production, so the output of concentrate during 1907 will work out at about 6200 tons, of which the average metallic contents obtainable by smelting will be about 60%. As above mentioned there are five smelting firms that bid for the ores. During 1907 Williams, Harvey & Co. of Hayle took the largest quantity. The Chyandour, at Penzance (owned by Bolitho), and the Cornish Tin Co., at Redruth (owned by Alfred Lanyon), followed next, while Bain's, at Redruth, and the Penpoll, owned by Strauss, on the river below Truro, took smaller quantities. No Cornish ores ever go anywhere else to be smelted. On the other hand, considerable quantities of foreign ores, from Bolivia, the Straits, Swaziland, and elsewhere, come to Cornwall for treatment, and the smelters themselves are shareholders in tin mining companies operating in the Straits and South America. The Penpoll smelter depends chiefly on Bolivian ores.

PIOCHE, NEVADA.

A Crisis Passed.—Resumption of Work.—Nevada Utah Co.—Ohio Kentucky Co.—Diamond-Drill Exploration.

Pioche passed a crisis. Owing to the decline in metal prices and the practical collapse of the ore market, the mine-owners of the camp had formed a rather loose agreement to adopt a lower scale of wages. The Miners Union protested against this and finally voted not to go to work. Nearly all operations had stopped and the outlook was for a period of paralysis. On January 6 a compromise was reached and a revised scale adopted. This gives hoist-engineers, mine-blacksmiths, and timber-framers each $4 per day; machine-men and their helpers, tool-sharpeners, and timbermen, $3.50; hand-miners, $3.25; dry-shaft work, 50 cents a day more than drifting; wet-shaft work where the miner furnishes his own waterproofs, $1 extra, and where the company furnishes them, 75 cents; minimum underground and surface wage to be $3 per day.

The Nevada Utah started up at once when this compromise was effected, and other properties have been gradually falling into line. James P. Gaskill, chief engineer of all the Nevada Utah properties in both States, came the latter part of December and L. W. Wiekes, the superintendent, followed him on January 2. They started the Day mine at Jack Rabbit and immediately began shipping a car of ore per day. That is a low-grade mine with an enormous tonnage. Under present conditions the returns were so low that Mr. Gaskill at once entered into negotiations with the Clark railroad for lower rates and these have just been announced. From Pioche to the Utah Valley smelters the rate on ores of $10 net value or under (assay-value, less smelter charges) is to be $3.25 per ton, and for ores between $10 and $15 the rate is to be $3.50. This is a concession from the present tariff of 75 cents and 50 cents respectively. In the discussion about a lower rate than $4 per ton on very low-grade ores, much has been said about the rate of $2.75 per ton on $12 ore from Eureka, Nevada, to Utah Valley smelters. In making comparisons of this kind one must not overlook the profile of the railroad that carries the ore. Between Pioche and Salt Lake the vertical height to which a car of ore must be raised aggre-

gates about 3250 ft., while from Eureka to Salt Lake it aggregates less than 1500 ft. The mileage is practically the same. Against this advantage of grade between Eureka and Salt Lake is the fact that ore from Eureka must be trans-shipped at Palisade from narrow to broad-gauge cars. Mr. Gaskill is negotiating for another engine for the company's private line between here and Jack Rabbit, and as soon as that arrives it is the purpose to ship not less than two hundred tons a day from that point.

The Ohio Kentucky resumed work last Sunday with its old force. No report has come from the negotiations at New York looking to the admission of the Ohio Kentucky to the consolidation being formed to take in the Nevada Utah, Balaklala, etc. The Nevada Utah has long been threatening to bring an apex suit against the Ohio Kentucky, claiming nearly all of the vein thus far disclosed in their workings. This controversy would be avoided by a consolidation. The situation exemplifies once more the folly of keeping our idiotic law of apex on the statute books. Each case tried brings out some new condition not previously in evidence. This case, if it reaches the courts, will be no exception. It will be intensely interesting to students of legal jurisprudence, but an unmitigated evil in its effect upon the activities of this camp. From that standpoint consolidation would be a blessing.——The Prince is to start up again in February. The Bristol Consolidated is perfecting arrangements to work again.—— The Lincoln-Nevada, Nevada Pioche, Boston & Pioche, Nevada Horn Silver, Pioche Demijohn, Pioche Milwaukee, California Pioche, Pioche Mohawk, Pioche X Ray, Pioche Mines, Last Chance, and Lucky Star companies are all working with small forces and most of them are taking out some ore for shipment. The Mendha is only waiting for an ore market to begin shipping at least a car per day. The Ely Valley Mining & Milling Co. is a corporation recently financed in London to take over the old Harrison Eilers property about three miles northwest of Pioche. They are sinking on a strong vein that has yielded good ore from the shaft, which is down 125 feet.

James Nesbitt and his associates are working their property called the Gypsy Group, in the Highland district, not far from the Mendha. They are getting out some ore carrying up to 500 oz. silver.

The most interesting development in progress here today is the diamond-drill exploration by the Nevada Des Moines Co. They have a claim on the eastern edge of town on which they sank a shaft about 240 ft. Recently they drilled 250 ft. from the bottom of that shaft. The town of Pioche and the great mines on the hillside are on a strip of quartzite that was uplifted more than 1000 ft. above the alternating beds of shale and limestone. These beds are probably in approximately their original position at the Nevada Des Moines. The drill went through several layers of limestone and shale, and near the bottom entered what appears to be a rhyolite tuff. The very last of the core was ore of such grade that the management immediately ordered a 40-hp. gasoline hoist, with air-compressor and machine-drills. They give out meagre information, but the manager, D. C. Mahedy, tells me that the ore was of excellent grade and highly satisfactory. The Nevada Utah has just closed a contract with the same drill outfit for 5000 ft. of drilling. Altogether the prospects here now seem extremely favorable. Several new enterprises are nearing consummation, which cannot be mentioned yet, but which promise much for Pioche.

BUTTE, MONTANA.

Production Last Month. — Conditions Continue Gloomy.——Butte & London.—Parrot Shaft.— Butte & Superior Mortgage.

The estimated copper output of the Butte district in January was 9,057,250 lb. Only four companies were producing, in addition to a few lessees, as follows:

Companies.	Tons of ore.	Pounds of copper.
Boston & Montana	89,100	7,128,000
North Butte	4,000	480,000
Original	12,400	992,000
Pittsburgh & Montana	3,410	341,000
Miscellaneous	1,550	116,250
Totals	110,460	9,057,250

The Boston & Montana output represents the total production of the Amalgamated, as all the other properties of that company are still closed down. The ore mined by the North Butte is limited to the ore taken out in the course of development on the 1800 level. The Pittsburgh & Montana is treating about 110 tons of first-class ore mined from its own property and also handles a little custom ore. So far as can be ascertained in Butte there is no immediate prospect of a revival, except that the Original will increase its production as soon as the shaft of the Original mine is completed, it having been closed pending re-timbering. Financial conditions are tightening, rather than relaxing, as regards some of the new companies that have been trying to maintain development work. The companies are rich in treasury stock, but the stock can not be sold now except at a sacrifice.

The Butte & London Copper Development Co. is still doing exploratory work on the 1100-ft. level, and is driving on two veins, the most promising of seven veins that have been cross-cut. While some good assays—about 4 oz. silver and 2.5% copper—have been taken from the vein, it is becoming evident that greater depth will be required to get to profitable ore. H. V. Winchell, chief geologist for the Great Northern Railway and formerly with the Amalgamated Copper Co., made a report in which he said that he knew of four veins that traverse the Butte & London ground, but the company has found seven veins within 500 ft. of the shaft. They are from 6 to 20 ft. wide. The chairman of the Venture Corporation is on his way from London to meet the officers of the company. The Venture people have made several overtures to get control of the Butte & London, and it is considered probable that the deal will be consummated at the approaching meeting.——A report of the December operations

on the Barnes-King states that about 4000 tons of ore were mined and milled that month, the gross value being under $4 per ton, which did not pay.

MEXICO.

San Toy Affairs.—Railroad Freight on Ore.—Tezuitlan Smelter Business.—Conditions in Oaxaca.—Tehauntepec Silver Mines.—Oil in Chihuahua.

An important change has been made in the operative force of the San Toy Mining Co., Santa Eulalie district, Chihuahua, due to a practical re-organization of the company. R. R. Brown, of Pittsburg, has resigned as president of the company, and J. P. Hutchinson as general manager. Mr. Hutchinson was the real promoter of the company, and though he still remains as a stockholder, he now gives up all active connection with the company and will first give his time to the case which is now before the Supreme Court of Mexico City. This concerns the Dolores claim, which was held under titles dating back among the oldest in the Santa Eulalie district, but which were set aside and possession forcibly taken from Mr. Hutchinson on a ruling of the Court of the Fifth Sala in Chihuahua, based on some technicalities in the new mining laws, but whether rightly or not it now rests for the Supreme Court to decide. The holders of all old titles to mining properties in Mexico should side with Mr. Hutchinson in this suit. The offices made vacant by the resignation of Messrs. Brown and Hutchinson are at present both to be filled by Donald B. Gillies, recently from Tonopah, Nevada, but formerly for some years with the Clark mines at Butte. Mr. Gillies' experience, therefore, in the handling of large bodies of low-grade ore will be useful to him in his present position, for the San Toy, though having large deposits of iron oxide ore, is unusually low even for Santa Eulalie ores in both lead and silver, and it is already reported that the output is to be doubled as soon as possible, which will bring it up to between 300 and 400 tons per day.

The railroads are feeling the effects of the low prices of the metals, not only in the great falling off of shipments by reason of the curtailment of production in all directions, but also in the question of increased freight rates, for which they have been urgently seeking. As has already been stated in these columns, the commission, before which the question of all new rates has to be presented, while by no means permitting the exorbitant increase in rates as requested by the railroads, did admit of a compulsory classification of ores under 25 pesos valuation, those between 25 and 50 pesos, and those over 50 pesos, and an increase in the rates of 10, 20, and 30% in these three classes of ore. Not satisfied with this, however, the railroads have made an appeal to Leonardo Fernandez, Secretary of Communication, asking that they be allowed, if not their original schedule, at least a material increase over that admitted by the commission. However, under present conditions, it is not believed by many that the railroads will get their demands.

The stopping of purchases of custom ores by the Tezuitlan Copper Co. for its smelting plant promise to be a serious blow to the mines in the various districts of Oaxaca, but an arrangement was affected between the Consolidated Metals Co., which has many contracts for ore throughout Oaxaca, and Seckbach & Co., ore-buyers of Mexico City, whereby the ores of such properties as wish to produce under the present markets are taken care of. But many have suspended in Oaxaca, and the Taviche district is quiet, although the Conejo Blanco continues its shipments of high-grade gold ore. Others are still shipping to the smelter of the Magdalena Smelting & Mining Co., this being the name of the new company organized by Mr. Hamer in New York last fall, with a capital of $5,000.000, and which will absorb the smelter and mines of Messrs. Hamer and Williams, though both retain large interests in the new company. Henry W. Catlin, of New York, president of the new organization, has been on a recent trip of inspection, and is quoted as saying that a large part of the new capital will be put into many necessary improvements at the smelter and in opening the mines, particularly the San Carlos and Providencia, in both of which the increasing supply of ore has been most encouraging. The Tehuantepec Silver Mines Co. of Boston, which recently purchased the San Francisco mine in Taviche, has now acquired also the adjoining properties, consisting of Rey de Plata, Carmen, San Albino, and Amplicacion de Las Animas from the American Consolidated Mining & Smelting Co., controlled by A. W. Cunningham and associates of Waco, Texas. The properties are at present twelve miles from the railroad, but only one mile from the new road, and under proper management will undoubtedly become one of the large mining enterprises in Mexico. And further encouragement is given to this and to the Oaxaca district, by reason of the concession obtained by S. P. Applewhite for the installation of an electric power-plant to be operated by the waters of the Rio Grande. The presence of R. L. Stevens and W. Harvey Weed in Mexico City on the way to Chilpancingo and the Balsas River district in the State of Guerrero has given rise to the rumor that the Tennessee Copper Co. is going to buy and build in that vicinity.

Chihuahua is quite jubilant over the results of the drillings for oil that have been carried on by W. R. Hearst and James Keene, at the instance of C. R. Troxel, and which have resulted in striking oil in one hole at a depth of 1400 ft., in another at 400 ft., and a third hole has just been started. The holes are in the eastern part of Chihuahua, near Ojinaga or Presidio del Norte, and along the line of the Kansas City, Mexico & Orient railroad. The first hole is only about six miles from the Rio Grande, and the work is proceeding south in a more or less direct line with about six miles between the holes. The original concession was for 5000 acres, but now these pioneers are after 200,000 acres additional. An analysis of the oil from the second well is said to have given:

	%
Naptha and light oil	14.38
Light kerosene, 150° F.P.	31.05
Heavy " 128° F.P.	22.60
Lubricating	20.00
Paraffin	10.22
Total	98.25

This is an oil much to be preferred for general use over those of the San Luis Potosi and Vera Cruz fields, which have an asphalt base. The endeavor was to keep matters as quiet as possible, but results leaked out, and it is said that E. L. Doheny of the Mexican Petroleum Co. (S. L. P. & V. C.), and others are scouring the new fields. And as this chances also to be near large zinc deposits the visionary ones already see a replica of the Kansas fields with the oil burning, gas flaming, and stand after stand of zinc smelters. Premature as this may be at this time it seems certain that there is money here in Mexico for the man who will go into zinc smelting, in the region mentioned above if the oil proves up, or near the coal and zinc fields in the vicinity of Monterrey. The call for zinc in Mexico is becoming greater and greater every year, and there is money for the man that will smelt the ore here, and follow up his product by putting it into marketable shape.

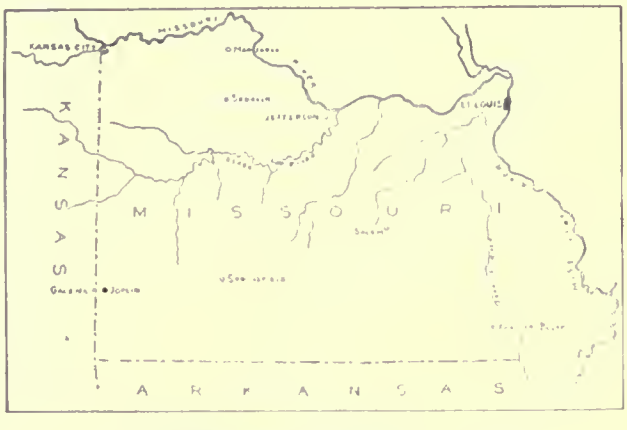
The Blaisdell Coscotitlan Syndicate, for which H. A. Barker is general manager, has acquired a large area of ground three miles southeast from Pachuca. The tract is flat, and lies on both sides of the Pachuca river, whose banks are low, permitting its flow at times to spread over the entire plain. This area has received the tailing from the old mills of Pachuca, as well as the wash from the mineral-bearing hills of the district, and is covered by a deposit of silt and sand to an average depth of 2½ ft. Such deposits include the accumulations of mill-tailing of a century or longer, but the bulk of it resulted from operations during the last 40 years. Mr. Barker estimates that there are 2,000,000 tons of material that may be successfully cyanided for the gold and silver it contains. Much of this tailing resulted from the *patio* process, and is in a finely divided state. It is estimated that it will average between P7 and P8 per ton, being 75% silver, and 25% gold. The silver is a sulphide and the gold is associated with it. The material also contains considerable iron. With this kind of a proposition the company began last fall to erect a plant for digging, conveying, re-grinding, and cyaniding the material. The work began Oct. 7, 1907, and on Dec. 27 there were 20 steel-vats, miles of pipe-line, chutes, conveyors, and other equipment in readiness. The plan is to begin operating by Feb. 15, 1908. The material will be taken up and placed in tram-cars with side dump, which will discharge into a chute, within which a Blaisdell conveyor operates. By this means the material will be elevated 30 ft. and dumped into pulping vats. Callow screens will be used to take out the vegetable matter. The mixed pulp is to be classified by spitzkasten, the coarse sand being discarded for future treatment. The slime will be re-ground in Krupp tube-mills, reducing it to sizes ranging from 80 to 150 mesh. The tube-mills are lined with the El Oro lining. The pulp will then be further subjected to cyanidation in agitating vats. A 5-ton plant will be erected to test the Adair-Usher method of slime-leaching, in which the material is held in suspension while the cyanide solution is passed through it. It is a method used on the Rand. The 20 steel-vats are each 36 ft. diam. and 11 ft. deep, except three sand-filtering vats, which are but 8 ft. deep. The pumps, conveyors, tube-mills, and other machinery will be operated by electric power. The final clarification of the solution will take place in a Blaisdell filter, after which the solution will pass to the zinc-boxes for precipitating the metals. They are putting in ten zinc-boxes, each 17 ft. long, 4 ft. wide, and 2 ft. deep. The precipitate will be melted in steel crucibles. Designs are made for a refinery for separating the gold and silver. The plant will have the capacity of 500 tons per 24 hours.

The Tiro General mine at Charcas, San Luis Potosi, is well developed, and is shipping 4000 tons of ore per month to the smelter at Aguascalientes. These shipments carry 2½% copper, as a mixture of sulphides and oxides. In the mine are separate bodies of galena, zinc-blende, chalcopyrite, and iron in a silicious and lime gangue, which are to be concentrated in a plant just installed under the advice of R. C. Canby, of El Paso. It is equipped with crusher, four sizes of rolls, sizing screens, and Sutton & Steele tables for dry concentration. There is a separator for collecting the fine dust before the bulk of the pulverized material passes to the screens, the latter making five sizes. Each sized product is concentrated on a separate table, which is said to have a capacity of 40 metric tons per day. It is also proposed to employ a di-electric separator for separating the copper from the zinc after these have been parted from the lead and iron. J. G. Creveliug is general manager of the property.

JOPLIN, MISSOURI.

Resumption of Work on Better Prices for Lead and Zinc.—Output of Various Mines.——Successful Prospecting at Webb City.——The Oronogo District.—Work at Aurora.—A New District in Oklahoma.

The re-opening of practically all the mines of Joplin camp and 40% of those at Webb City, following the increase in the prices of both lead and zinc ore, is the leading feature of the past fortnight. The price of zinc concentrate running 60% zinc, advanced to $40 per ton, while lead concentrate running 80% brought as high as $45 per ton. This price makes possible a profitable operation of all the



Sketch Map Showing Position of Joplin.

mines working orebodies running as high as 5%. The weekly production of the district is still below 3500 tons of zinc and 600 tons of lead, when normally it is above 5500 tons and 1200 tons. The plants that have resumed operation should increase the zinc output at least 600 tons. A majority of the operators in the sheet-ore belts will not re-open their plants until zinc reaches a base of $45 per ton. Until then Webb City and Prosperity, from which comes the major portion of the tonnage of both lead and zinc, will not produce. The Underwriters Land Co., handling 1000 tons daily, has not been able to agree with the workmen as to a lower wage scale, and the plant remains idle. The American Zinc, Lead & Smelt-

ing Co., which has six plants in the Prosperity-Porto Rico camp and having an aggregate daily tonnage of 3200 tons, has not resumed work. At all the mines resuming work lower wages are paid, the decrease ranging from 15 to 25% as compared to before the panic.

During the enforced shut-down most of the large operators have undertaken a complete overhauling of their plants and they are making repairs looking to an increased tonnage when the mills resume work. The old companies have done much dead work in their drifts, while others are prospecting new tracts. The most important development in the Webb City district is the completion of the prospecting campaign of the Glass Mining Co. on its 160-acre tract in the north sheet-ore field. The company put down 30 drill-holes, all of which penetrated ore from 180 to 225 ft. The orebodies were in a few instances 24 ft. thick. A double-compartment shaft has been sunk and cross-cuts driven, so as to prove the records of the drill. A 400-ton mill has been erected. A second shaft has been started to intercept one of the drifts in order to provide ventilation and a sufficient hoisting capacity to keep the mill in steady operation. The Indiana Mining Co., a sub-lessee, has sunk a shaft and opened the same run of ore and is now erecting a concentrating plant. These developments add 160 acres to the proved sheet-ore belt of the north Webb City field. ——At Oronogo, the Old Judge Mining Co., at one time a heavy producer from the upper levels, has opened a new body of sheet ore at 180 ft. The ore runs 8% zinc concentrate. A drift 90 ft. from the shaft has revealed a uniform orebody. A second shaft is being sunk and a 250-ton milling plant is now completed. The discovery will revive many of the abandoned mines that were supposed to be barren below the old levels.——The Mercantile Mining Co. completed its new concentrating plant at its No. 1 shaft. The plant is an innovation in mill structure, being of steel throughout, with a steel storage bin of 500 tons capacity. The mill is covered with galvanized sheets and all the floors in the building are concrete save that of the jig-room. This, together with the jigs, is the only wood found in the entire mill. The plant will handle 250 tons per 10-hour shift and is constructed to handle sheet ore yielding from 3 to 4% concentrate. The power plant consists of two Snow gas engines of 200 hp. each, one driving the mill and the other the 12-drill air-compressor. This is the only completely fireproof plant ever constructed in this district, though the utilization of galvanized sheets as a mill-covering has become a settled practice.——Adjoining the Mercantile lease the Carbondale Mining Co. has just completed a 250-ton plant to handle the same character of ore. A feature of this company's plant is the installation of hoisting cages in its double-compartment shaft. The cages and hoisting arrangements follow the plan of those used in the coal-fields of Kansas. This feature is found at only one other plant in this district.——The Tri-City Mining Co., at Carthage, has undertaken the development of a new tract of land northwest of that city and the results have been gratifying. The drilling done on 80 acres of the tract has developed two runs of the ore, one at the western extremity and one on the east forty. The first showed ore at 240 ft. and continued to 258 ft. The ore discovered was a mixture of galena and zinc-blende, the latter predominating. On the east 40 acres ore was found at 228 ft. and showed a 16-ft. face of disseminated ore in a chert matrix. A shaft is being sunk on this land and a concentrating plant will be erected.

At Aurora, Scott & Coleman have just completed prospecting a new tract of land east of the limits of the old camp and discovered a new orebody at a lower level than had been previously demonstrated. Ore was encountered at 268 ft. and a deposit 30 ft. thick was penetrated. A shaft has shown the drill records to be correct. Drifts have been pushed east and south of the shaft; while the underground work is progressing, a concentrating plant is being erected. On this 80-acre tract 27 drill-holes have been put down. Drilling is being continued to determine whether the new discovery is an extension of the orebody in the Sand Ridge mine on the north. The discovery was made on the south end of the new tract.——The Sand Ridge mine, employing 150 men and working at the 300-ft. level, has been re-opened. Operations were discontinued two years ago, when a disastrous cave flooded the mine. The cave occurred beneath the bed of a stream flowing across the property and for some time all hope of re-opening the mine was abandoned. The company was re-organized and built a flume 1600 ft. long to carry the stream over and around the caved ground. The feat was successful, and after two months steady pumping the water was lowered to the working levels when work was resumed in one of the most productive mines ever opened in Aurora. Heavy timbering had to be done in the lower levels to secure the drifts under the caved ground.

At Miami, in Oklahoma, prospecting has demonstrated an entirely new district, extending over several square miles. The ore is found in a sheet-ground formation at shallow depths as compared to Joplin and Webb City. Ore is found at 80 to 150 ft. The Emma Gordon Mining Co. has drilled 78 holes; a majority of these showed ore from 18 to 30 ft. thick. This company is sinking four shafts; one shaft is in ore, and at this point a 400-ton mill is nearing completion. Two other 400-ton plants will be erected at once to treat the output from the other shafts.——Amos Hatton of Webb City is developing a 200-acre tract. Five drill-rigs are at work demonstrating the limits of a sheet-ore body recently discovered. Four shafts are being sunk and a 350-ton concentrating plant will be finished in a fortnight. ——The Jennie May Mining Co. operating a 10-acre lease north of the city has opened a rich deposit of zinc. A concentrating plant will be erected.—— The following mining companies have drilled their leases and are now sinking shafts in this new camp: Lucky Strike Mining Co., Index Mining Co., King Jack Mining Co., Joplin-Miami Mining Co., and D. D. Isley.

Concentrates.

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

For the compressed-air supply for rock-drills, steam-turbines have begun to compete with reciprocating engines as motive power.

Hot blast has been abandoned at the smelter at the Copper Queen mine, Arizona, at Ducktown, Tennessee, and at Mt. Lyell, Tasmania.

Aluminum, sodium amalgam, and electricity have been tried in place of zinc shavings as precipitants for gold in cyanide solutions, but they are not practical.

The water issuing from the mines at Butte, Mont., is acid: pump parts exposed to it are made of phosphor-bronze and all columns must be lined with either wood or lead.

Drills sharpened by machinery are more perfect than those sharpened by hand and the saving in labor alone is estimated as amounting to at least 65%: this will in a short time pay for the machine.

Pyritic smelting, in which the sulphur in the ore is utilized as fuel in the blast-furnace, is increasing in use for the treatment of ores containing precious metals but poor in copper; this is especially true in districts where fuel is expensive.

In lead smelting there has been a tendency in recent years to revert to older methods; the reinforced dust chambers have fallen into disfavor, and the lime-roasting process does not appear to have been an unqualified success.

Ore on the dump in Arizona is personal property and not real estate, according to a recent decision by Judge Campbell in the District Court at Tucson, Ariz. Ore mined from the mineral claim of one party and dumped upon the mineral claim of another party therefore belongs to the party owning the claim from which the ore was mined.

The average cost of drilling 35 holes to a depth of 200 ft. through sand, clay, shale, soapstone, and sandstone with a hollow-rod drill was 18c. per foot. This included all labor, repairs on machinery and tools and a reasonable allowance for depreciation of equipment. The cost of drilling through jasper, marble, granite, chert, or very hard material will often average $3 per foot.

The amount of new gold coins issued by the Royal Mint during 1907 was £20,951,000, of which £18,800,000 was in sovereigns and £2,087,000 in half-sovereigns. The amount of gold coin withdrawn from circulation was £2,700,000. The new silver coins issued numbered 37,343,000, having a face value of £2,019,789; and 68,570,000 new bronze coins were issued, of the value of £227,550. All these figures show a considerable increase over those of 1906.

Calcined magnesite varies in price according to the amount of roasting given it; that resulting from the manufacture of carbonic acid gas brings a lower price than that specially calcined and given a longer roast at a higher temperature. The calcined magnesite at present sold in San Francisco brings $14 per ton. The crude magnesite costs in the San Joaquin Valley about $3 per ton and the freight to San Francisco is about $3 per ton. The roasting is done at Porterville. The calcined material is mainly used as a digester for wood-pulp in paper manufacture.

Electric power for hoisting and haulage can be utilized to great advantage in the slate-quarrying industry. In Wales, for every ton of slate obtained from 20 to 30 tons of dirt, broken stone, and other débris must be handled. From the North Wales power-house a 10,000-volt current is carried about 50 miles to the Darbishire, Dinorwic, and Oakley slate-quarries, where it is lowered to the proper working-pressure for light and power service. A total of about 5000 hp. is installed in electric motors. The saving in cost as against the use of coal has been considerable.

The method of sinking shafts through water-bearing strata of sand or silt by sinking continuous cylinders and excavating the ground from inside them has reached its greatest development in Germany. A cylinder, usually of masonry built upon a massive iron cutting-shoe, is sunk until skin-friction prevents its further descent. Tie-bolts attached to the cutting-shoe are built into the brickwork and by means of these a heavy iron anchor-ring is secured to the upper part of the shaft. A cylinder of iron is then built up beside the first cylinder; it is forced down by powerful hydraulic presses which work against the anchor-ring. Modern practice seems generally to favor the use of some form of dredge for excavating the material from the inside of the cylinder.

The amount of water which can be decomposed in a given time by an electric current is directly proportional to the strength of that current, therefore, the amount of water that can be decomposed by 1 hp. hr. is dependent upon the current-strength used. At 100 volts 1 hp. hr. equals 7.46 amperes flowing continuously for one hour, during which time it would decompose 0.28 gram of water. The amount of water that can be decomposed by any number of watt-hours in a given time may be determined by multiplying the watt-hours by 0.0373824 and dividing by the voltage. The result will be the weight (in grams) of the water decomposed. The most suitable electro-motive force is dependent upon the size of receptacle retaining the water, also the size of plates used, and their distance apart. Ordinarily for electro-chemical processes, from 5 to 10 volts is found most suitable.

Discussion.

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy.

Cyanidation of Ore Containing Both Coarse and Fine Gold.

The Editor:

Sir—Under 'Discussion' in the issue of December 21, Mr. E. M. Hamilton suggests re-grinding, with the idea that the gold would be either disintegrated or flattened into very thin plates. Undoubtedly there is a difference in the physical condition of gold occurring in different places, and it is possible that all gold might not yield readily to this treatment. This idea is suggested by an experience at Cooke City, Montana, where in one part of the mine we found free gold that failed to dissolve after four days exposure to an 0.25% cyanide solution. The ore was crushed dry by rolls through 20 mesh, but an examination of the tailing showed that all of this gold would pass 60 mesh, and nearly all would go through 100 mesh. After the sudden rise in the value of the tailing due to the unexpected appearance of this free gold in a mine which had rarely shown a color, amalgamated plates were introduced into the sluice-boxes through which the tailing was discharged. Practically none of the gold was saved, and then different types of riffles, with quicksilver, were tried and proved unsatisfactory. Following this, blanket tables were used, a concentrate running up toward $1000 per ton was obtained, and the tailing dropped back to an approximately reasonable figure. Possibly if this gold could have been put through a tube-mill and ground to 250 mesh it would have dissolved satisfactorily, but with our conditions, though it passed the finest screen we had, it would not dissolve.

GEO. A. PACKARD.

Boston, January 15.

The Editor:

Sir—If further discussion of your question regarding the treatment of ore containing coarse gold is in order, I would like to offer the following suggestions:

I infer from Viator's communication that the crushing must be done in cyanide solution, otherwise amalgamation followed by cyanidation would be the natural course. Even when using cyanide in the batteries I believe the same plan is the best for the purpose, provided the solvent action of the cyanide on the plates can be avoided. This I think can be done in a simple way by making the plate the negative electrode of a galvanic couple, for it is well known that the cathode is not attacked by the electrolyte while the current is flowing. By making use of this fact we ought to be able to protect the plates from all action of the cyanide, and perhaps make them a little more active as amalgamators. The couple ZnCuHg (amalgamated plate) gives a potential difference of 0.35 volt in a 0.1% cyanide solution, the current going in the solution in the direction indicated by the arrow, thus making the plate the negative element, or cathode.

Should any one care to try the experiment I would suggest placing a few narrow strips of zinc along the edge of the plate, and insulated from it by a thin strip of insulating material. The strip of zinc and the insulator might be fastened to the plate with a couple of copper rivets, which would serve to short-circuit the couple and make the amalgamated plate the cathode, and thus protect it from the solvent action of the cyanide. The solution carrying the pulp over the plate would be the electrolyte, and the current would go from the zinc through the solution to the plate and back through the rivets, thus completing the circuit. The zinc should be bright and clean, as cyanide seems to have but little action upon ordinary rolled zinc.

I believe a few such couples around the plate would be sufficient to protect it from the action of the cyanide, and the amount of zinc going into solution from the anode would be so small as to be of no importance.

Should this method not give sufficient protection, another plan would be to use a carbon anode placed in some convenient position and just touching the pulp, and then pass a very weak current from it through the pulp to the plate and then back to the generator. Probably one ampere, or even less, of current would be sufficient for the purpose. By protecting the plate in this way any desired strength of cyanide could be used, which might prove particularly advantageous in the case of silver ores when a strong solution is necessary.

JAS. S. C. WELLS.

New York, January 18.

Labor Conditions in the Coeur d'Alene.

The Editor:

Sir—You would do a justice to this district if you would kindly publish the following in answer to 'A Word for the Miner' in your issue of December 21.

On page 774 I find the following statement: "The average employee of a mining company can either accept the treatment offered him, or get out. He has no appeal, no chance to be heard; if he takes exception to some arbitrary rule of the management, he gets his time. If he moves to a new camp he meets the same conditions." From this statement one would think that the above was an unusual condition and applied solely to the mining business, yet as a matter of fact the same condition is found in any and all industries. The farmer tells the farm laborer when to sow the wheat; the captain tells the sailor when to scrub the deck; the railroad rules and regulations tell the engineer the time and conditions under which he is to run his train; and the army regulations prescribe the rule of drill for the soldiers. If such were not the conditions throughout the world it would be impossible successfully to carry on any great industry or enterprise. If each laborer on the Panama Canal were given an opportunity to dictate the policy that was to be pursued for one day we would certainly reduce that great work to chaos.

In reference to the employment office, there was one established at Wardner, and another at Wallace, shortly after the blowing up of the Bunker Hill mill in April, 1899. The original purpose of these offices was to prevent the employment of union men, but the system has worked so well and given such satisfaction that these offices have been continued up to the present time. Under the old system of the miner applying to the foreman of the mine for employment, the foreman was annoyed and interfered with at all times by men applying for work; and in the more accessible mines of the district such a foreman could do little but answer the men making application, so that very little of his time was devoted to his real duties of directing the work in the mine. Again, some excellent foremen would soon surround themselves with their personal friends; these they would later allow to take advantage of them to the detriment of the company, and the efficiency of the miner would soon reach such a low point that it would become necessary to discharge the mine foreman and his entire crew of followers. The employment bureau removes all these difficulties by having central offices in the towns of the district where they are accessible to the men seeking employment, and are directly connected by telephone with the mine foreman. Today we find in all large well-managed industrial works that there is a man in the office specially employed to hire men, and the foreman's attention is devoted to the overseeing of the labor, and such will soon be the conditions at the mines.

With reference to Jack Bayne, he is one of the most honorable, honest, and kind-hearted men that I have ever met, and I have known him to send men who were discharged from one mine to some other mine until they had been finally discharged from every mine in the district. He was formerly a mine foreman in this district, and it is true that he has not received the diplomatic training, nor has he acquired the polished manner of our genial Secretary of War, William Taft, yet he has always treated any man seeking employment most justly.

Some of the mines of the district are so situated that they were compelled to erect boarding-houses for the accommodation of their employees, others have never had a boarding-house, and a few, known as the Federal properties, have both stores and boarding-houses that are commonly reported to be owned by the officials of this company. I have eaten in numerous boarding-houses in the mining districts of the West, from Mexico to British Columbia inclusive, and I can honestly say that the boarding-houses of this district average better than those of any district in which I have ever been. The Standard boarding-house is a well built frame building, equipped in the most modern manner, electric-lighted and steam-heated throughout, divided off into rooms, most of which contain two single beds, and if it so happens that one bed is occupied by a man working on day-shift and the other at night, it certainly becomes necessary to call the man working on morning shift. Unfortunately, mines are not always found in the most desirable places, but I fail to see how the management is to blame for this fact, or how the working man could change it, and in the development of the Standard it was necessary to run an adit from a narrow canyon less than 300 ft. wide; in the centre of this canyon we find a mountain stream, and on each bank a railroad, so that under these conditions the only available place to construct the boarding-house and other necessary buildings was between the two railroads; yet even as it is, as far as smoke and dirt is concerned, the conditions are much more favorable than in the centre of the business district of the City of Pittsburg; and we cannot expect to obtain industrial activity in any portion of the world without some of its inconveniences. One dollar per month is deducted from each employee in this district for hospital dues, this amount being paid directly to such hospital as the miner desires to patronize. The section in reference to the insurance is a misrepresentation of the facts; a system of insurance was introduced here some two years ago, and a complete set of rules governs and regulates this system, however, the final governing board consists of four members, two chosen by the mine-owners, and two by the men, and this board has the final power to do that which it thinks is just and equitable.

The following is a general outline of this system: Each miner is charged $1 per month for insurance, provided he works ten or more days in a month; if he works less than the above number of days he is charged ten cents per day; to the sum so collected the company adds one-half of such amount, and in case of accident causing partial disability the miner receives various sums not in excess of $1500. In case of death the family of the miner receives $1500, or those directly depending upon him may (at the option of the board of directors) receive the same amount; in case of death without any family, or anyone directly depending upon him, the funeral expenses are paid by the insurance association. This system has worked well and there are only two improvements that I would suggest to make it nearly perfect: First, the company to contribute the same amount as the workman; second, each region to be divided by law into mining divisions as at present for locating mining claims, and each such division to be compelled to maintain one insurance company to which all the mines in the district shall contribute, so that the men employed in a small mine will receive the benefit of such insurance, the same as the employees of the larger mines now.

In reference to the heat in the summer time, I do not just see how that could be changed by consulting with the miner, and as a matter of fact the conditions here in the summer are the most favorable of any mining camp in the entire United States; during the past year we had only a week of what might be termed summer weather, and during that week the thermometer did not register as high as 90° in the shade during the hottest portion of the day. As for flies, a man working in a mine has little conception of what real flies are, and if he will take a trip to a farm house, a surveyor's camp, or a railroad construction camp, he will come back to the mines

pleased to know that he is engaged in an occupation where he is not annoyed by 'real flies.'

As for pneumonia, we must admit that any man working in a warm place, where the ventilation is poor, is liable to this disease on being suddenly exposed to the cold air for an extended period of time, but the avoiding of this disease is entirely within the hands of the miner, and if he will take ordinary precautions to protect himself he will not be troubled with pneumonia. A most frequent cause of his contracting this disease is the habit of spending the evenings in a poorly ventilated saloon, playing cards, and drinking alcoholic liquors until a late hour, when the miner goes home to his damp cool cabin in a partially intoxicated condition and by morning he is chilled through and the blood has congested in his lungs.

The Coeur d'Alene foundry was conducted here for more than ten years by parties that were not directly interested in any of the large mines, and a few years ago one of the partners, a Canadian by birth, died, leaving his estate to his relatives in Canada; after various negotiations the operators in control here, with one exception (and this for personal reasons), took over this interest and advanced the money necessary to equip the plant, and any man that has ever conducted any mining enterprise will appreciate the great advantage that the mine-owners now possess in having a properly constructed and conducted works of that nature in which, at a moment's notice, they can have repairs made, or any parts of machinery duplicated, and by possessing this interest in the works they have placed themselves in a position where they can adjust and regulate prices on an equitable basis.

With reference to the struggle of the owners of the Hercules with the Federal company, this is mostly a matter of imagination, and the relations of the two companies have been much more pleasant than the relations of the Bunker Hill company and the Federal company, but the fact that the Hercules has always been a union mine has greatly magnified the true facts in the minds of all the union element. The statement that the Bunker Hill & Sullivan mill was blown up on account of a cut in the already low wages paid the men, is not correct. The mill was blown up in April, 1899, and the rate of wages paid at that time was the same as had been paid for the seven years previous, namely: Shaft and timber-men, $4; miners, $3.50; car-men and shovelers, $3 per day. The blowing up of the Bunker Hill mill was the most foolish act ever perpetrated by any body of working men, and it was one of the greatest injuries to the cause of Union labor that has ever occurred in the West. At the time of the blowing up of that mill every mine in the district was a Union mine with the exception of the Bunker Hill, and more than one-third of all the men in that mine were members of the Union. The Union sent an ultimatum to the Bunker Hill to discharge all non-union men and make the Bunker Hill a Union mine; and the refusal of the Bunker Hill to do so was the sole and only reason the Union men had for the destruction of the property, and by the destruction of that mill the Union lost all the prestige that they had obtained during the seven years previous, and they have not been able to regain it during the seven years since then.

In conclusion, I may add that I am not in the employ of any mining company in this district, and am not a mine owner in the district, and it is not a personal matter with me in any way. My only desire is to correct errors and furnish unbiased facts.

J. P. K.

Wallace, December 24.

College Instructors.

The Editor:

Sir—I have read Mr. John A. Reid's most interesting letter; but he seems to me to miss the one thing we lack in all our colleges, and that is the magnetic professor who creates enthusiasm. I have crept in to many a college class-room, and listened to well-prepared and thought-out lectures; but never once, in this broad land, have I been thrilled as I have been in the colleges of Europe. Why? Because the lecturer was always weighed down by the spirit of commercialism; I mean, he seemed always to be striving to give instruction that would pay to know; and this is certainly not the right spirit for colleges, nor will it produce really great men.

I remember when a student at Freiberg, how Bernhard von Cotta inspired me to make petrology a life study how his talks, both in the lecture-room and in the field, thrilled me, and they have not only given me a great joy in life, but have put lots of money into my pocket as well. Man is a warm-blooded animal, and if his blood be cooled by cold-nosed commercialism, he will never do good work or inspire the young. My private tutor in Freiberg was Theodore Richter, the discoverer of indium, and he taught me metallurgy, spectroscopy, and blow-pipe analysis, for 25 cents (ye gods!) a lesson, nominally of one hour, but usually two to three hours; and he would never take more than 25 cents; so when I left, I gave him a box of cigars (all he would accept), and as he embraced me, tears stood in his eyes. We never met again, but the enthusiastic 'send off' those two great men gave me, has been worth 'millions' to me, in my life-work. I owe an untold debt of gratitude to the enthusiastic teaching of Faraday, Williamson, St. Claire Deville, and Hofmann in chemistry; Miller in mineralogy; Bonney, Morris, and von Studer in geology; Huxley in zoology; Tyndall, Maxwell, and Thompson in physics; Percy, Gruner, and Siemens in metallurgy; and many more. Now why is it we do not have lots of men of that stamp here? Our youth is eager and impressionable, and the field is ripe for the harvest. Why do our best painters live and do their best work abroad? It is because our social atmosphere is unkind to them. And so it is, and more so, to men of science.

We are living here now in an age of 'brass' or 'iron'; and history does not record the names of any great teachers in the 'stone,' 'bronze,' or 'iron' age: it may be an 'age of gold,' but certainly not a 'golden age.' When a learned man ranks at least with a millionaire, there may be some hope for us.

After a while this will pass away, and a leisured—not a lazy—class will arise, and all will be well.

The college is emphatically a place of learning, of grand thoughts, and noble aspirations, and never must be dragged down by the spirit of commercialism. Practical instruction is very necessary, and we had it to the fill at Freiberg; at the same time, we had men there who could and did, add a higher plane of thought to their lessons. There are many well-known men in this country who are contemporaries of mine there, and I feel sure they will bear me out in my statements. I would not have missed my college education at Cambridge, Paris, and Freiberg for 'millions'; it has given me a joy in life and in my work that no money alone can ever buy; and to the question, did it pay? I answer: A thousand times Yes; not only in dollars, but also in a joyous life; and the longer I live, the more I feel I owe to those great teachers who started me right on my life's journey.

WALTER E. KOCH.

El Paso, January 21.

Green Gold.

The Editor:

Sir—The communication of Mr. T. K. Rose, the eminent chemist of the Royal Mint, London, which appeared in your issue of November 23, in relation to the report in the matter of certain experiments made by me in determining the cause of some gold having a decided green color, attracted my attention at the time of publication, but pressure upon my time precluded reply before this.

It was my impression, at the time we made the experiments last year, that we did not pickle the samples of alloy, but the reasoning of Mr. Rose being so logical, and feeling my memory might be at fault and that it was possible "that a cast and rolled alloy never shows a green color unless it is subjected to some pickling process which somehow converts part of the gold near the surface into the well-known violet or purple condition," I concluded to repeat the experiments I had previously made. Therefore I had 11 samples of fine gold and silver made up, beginning with 990 parts gold and 10 parts silver, and reducing the gold in each subsequent sample 10 parts and increasing the silver in a corresponding quantity. Each sample was numbered, and upon being flattened out after cooling, without pickling or other treatment, showed the following results as to the color:

No. 1	990	yellow
2	980	lighter
3	970	lighter
4	960	lighter
5	950	slight shade of green
6	940	increased shade of green
7	930	increased shade of green
8	920	increased shade of green
9	910	increased shade of green
10	900	decided green
11	850	full green

Thus it would appear that the presence of the silver in variable quantities is responsible for the change of color of the gold from a deep yellow to a decided green; and in all probability if the number of samples of alloy had been increased by the addition of the same amount of silver to each until the quantity of that metal should predominate, we would find the color shading off from green into a white.

FRANK A. LEACH.

Washington, January 25.

A Suggestion.

The Editor:

Sir—In your issue of January 18 is a suggestion by a 'Musher,' also an editorial on the same. This suggestion sounds natural and probably expresses the opinion of prospectors generally. Of all the departments of mining, the prospector is the only person who buncoes himself, and so often that it seems as though he took delight in it.

It has been the experience of the writer to have seldom met prospectors who knew where to look for a mine and where not to look for one, that their own descriptions of their 'bonanzas' have often been the cause of long and exposed trips to see nothing in the way of a mine. They always get picked samples for assay and their veins usually "widen as they go down." The geologic conditions that surround a body of ore, among which metamorphism, brecciation, and surface oxidation are usually apparent at the surface, are irrelevant to them.

It appears that the 'Musher' has things reversed. If any appropriations were to be made for advancing mining interests in new fields, the better expedient would be to take them to the United States Geological Survey, and have that department examine and report on them, which would be a source of reliable information, in contrast to the incoherent reports of prospectors.

W. P. R.

Seattle, Washington, January 25.

[Our correspondent is rough on the prospector, and puts us in an awkward position, for if we do not publish what he says, he can charge us with conducting a prejudiced paper, while by publishing his phillipic we place ourselves in danger of our lives. We hope any prospector that feels really badly about it, will give us the pleasure of a call, for, in the phrase of the camp, "the cigars are on us."—Editor.]

A Correction.

The Editor:

Sir—Kindly allow me to slightly correct your very complimentary editorial note of February 1, as I am somewhat sensitive in the matter of priority of inventions. It was Mr. Oliver who "hit upon a new idea." My part was to sit in judgment on his enthusiasm or comfort his despair.

ARTHUR DE WINT FOOTE.

Grass Valley, February 3.

ZINC DEPOSITS have been developed in Orange, Shasta, Mariposa, and San Bernardino counties, California. In 1906 shipments of concentrate carrying sphalerite and pyrite were made by the Western Zinc Co. from its Silverado mine in Orange county to San Francisco, where it was used for the manufacture of chemicals. At the Afterthought mine in Shasta county, the zinc-bearing copper sulphide ores were treated experimentally for making zinc oxide.

SMELTING IN GLOBE IN 1893.

Written for the MINING AND SCIENTIFIC PRESS
By L. S. AUSTIN.

During the years 1892 to 1894, N. S. Berray was superintendent of the Old Dominion Copper Co., at Globe, Arizona, producing blister copper from the oxidized ore of this property. Costs of labor and supplies were high, common labor being $3.25 per day, wood $7 per cord, and coke, after allowing for losses *en route*, $42.50 per ton. Naturally, with freighting so high, only the best coke was obtained, and the copper was put into its most concentrated form as blister.

The mine ore was as follows:

TABLE I. ORE ANALYSES.

	SiO_2	FeO	CaO	Cu
Surface tunnel stope (average)	34.6	26.8	2.0	15.8
Second level, main stope	32.0	34.0	2.1	11.6
Second level, northeast stope	25.4	34.4	3.7	14.1
Fifth level, richest quartz ore	49.4	19.7	1.1	19.8
Fifth level, black ore	31.1	32.1	3.2	13.1
Seventh level, richest quartz ore	39.2	25.4	1.1	21.2
Average	35.3	28.7	2.2	15.9

The last two ores contained 0.006 and 0.003% arsenic respectively, with traces of bismuth and antimony.

There were three furnaces, two being constantly in operation. These furnaces were of the round-cupola type, 36 in. diam. at the tuyeres. A new kind of wind-box on No. 2 furnace increased the temperature of the blast by 60° F; No. 2 ran faster than No. 1 and 3, with a maximum output of 80 tons daily. The increase over the other two furnaces was 10%. The works were not operated on Sundays, and the slag on Monday morning appears to have been higher in consequence.

Taking the performance for the second half of 1893, in 268 furnace days there were put through 15,510 tons of ore with a consumption of 2663 tons of coke, using 3570 tons of limestone, and producing 4,033,135 lb. blister copper, which contained 3,871,807 lb. fine copper. Counting 1039 tons of slag returned to the furnace, we have a total of 20,119 tons put through. The coke was 13.2% of the charge, the limestone 17.7 to 22.9%, figured on the ore put through. The ore, containing 14.2% copper, yielded 12.4% blister copper, while 1.93% went into the slag. There was thus a loss of 12.6% in smelting. Figured by the slag, which constitutes 83% of the ore put through, the loss should be 11.2% of the copper, the difference, as compared with the former figure, being presumably due to loss by volatilization and by flue-dust. The ore put through was 58 tons and the charge (including slag) was 75 tons per furnace-day. In this period of six months only 3.3 tons of custom ore was put through, yielding 2162 lb. copper. For steam-making there was used 633 cords of wood, or 2.2 cords per furnace-day.

The coke used was either Pocahontas (West Virginia) or Connelsville, each kind hand-picked. Analysis showed:

Coke	H_2O	S	C	Ash
Connelsville	1.16	0.99	90.31	7.04
Pocahontas	0.70	0.70	92.80	6.57

The copper bullion, or blister copper, carried but 3 oz. silver per ton and no gold. The table herewith gives some analyses:

TABLE II. OLD DOMINION COPPER BULLION IN 1893.

	March	July.	August.	September.	October.
Fe	0.12	0.72	0.74	0.80	0.97
Cu	98.91	98.27	98.30	98.24	97.52
S	0.64	0.60	0.55	0.53	0.69
As	0.057	0.039	0.040	0.54	0.052
Bi	0.010	trace	0.007	0.006	trace
Sb	0.008	0.019	0.014	0.021	0.014
Slag	0.065	0.060	0.120	0.007	0.180
	99.810	99.718	99.771	99.658	99.426

For the latter half of 1893 the mine expense is thus given:

TABLE III. MINE EXPENSE AND QUARRYING.

Tons of ore mined	15,210
Total mine expense	$79,334
Tons of lime quarried	3,571
Total expense of quarrying	$ 2,535
Cost per ton for	
Extracting ore	$2.520
Development	0.768
Superintendence	0.403
Timbering	0.671
Wood	0.319
Tramming	0.081
General expense	0.155
	$5.217
Cost per ton of limestone quarried for	
Labor	$0.537
Superintendence	0.089
Tramming	0.081
	$0.707

For the latter half of 1893 smelting expenses and weights were:

TABLE IV. SMELTING COSTS.

Tons of ore smelted	15,510
Total furnace expense	$137,959
Pounds of blister copper produced	4,033,135
Cost per ton of ore smelted for	
Labor	$1.243
Superintendence	0.063
Wood	0.282
Timbers	0.002
General expense	0.154
Coke	6.956
Coke lost at Wilcox	0.071
Coke lost at Globe	0.031
	$8.802

For the latter half of 1893 the expenses were, per pound of copper produced:

TABLE V. SUMMARY.

Mining	1.95 cents
Quarrying limestone	0.06 "
Smelting	3.71 "
Total cost per pound of copper	5.98 cents

Commenting upon these results and upon the almost extinct art of blister-copper smelting of oxidized copper ores, one notes, first of all, the high content of the resultant slag in copper. The ore was of a good percentage in copper, containing on an average 35% silica, yet it made 83% of its weight in slag. Had the ore contained 50 to 60% silica, as was the case with that smelted by the writer at Santa Rita, N. M., in 1899, the proportion of slag, and consequently of copper cost, would be in the same measure increased. Mr. Cooper, smelter superintendent of the Calumet & Hecla Mining Co., states that he has been able, while treating such ores, to bring down the percentage of copper in the slag to nearly 1% by the use of anthracite coal.

GOLD-DREDGING AT WAIPORI, NEW ZEALAND.—At one time 13 dredges were at work on Waipori Flat and its immediate neighborhood in Otago, but the number has been reduced to four. The Perseverance dredge was the last to cease operating. It commenced in January, 1901, and has had a much longer lease of active life than most Otago dredges. In 1905, it worked an area of 11 acres, handling 212,960 cu. yd. of dirt, which yielded 1129 oz. gold, which was valued at £4347. The total quantity of gold obtained by the dredge to the close of 1905, was 8645 oz. valued at £33,285 10s.; from this dividends amounting to £13,500 have been disbursed. The cost of the dredge was £3500; the average weekly cost of working, £40; average yearly cost of repairs, £420; and the yearly cost of coal, £700. The average number of men employed was six, and 45 was the average number of weeks worked during the year.

THE DOS ESTRELLAS MILL.

Written for the MINING AND SCIENTIFIC PRESS
By an Occasional Contributor.

The mines and two mills of the Compañia Minera Las Dos Estrellas are in the Tlalpujahua district, in the State of Michoacan, but within three miles of El Oro, in the State of Mexico. In fact the Dos Estrellas, geologically speaking, is in the same district as the mines of El Oro. The principal vein of the Dos Estrellas strikes through a schist, capped by andesite, like the parallel lode of the El Oro mine. Its strike is nearly northwest-southeast, with a dip of 70°. It is opened by two adits, both equipped with double tracks and electric haulage. Six Baldwin-Westinghouse 5-ton locomotives are in use. The first adit is 700 m. long, the second 580 m.

The Dos Estrellas Cyanide Mill.

Near the portal of the first adit is mill No. 1, which has been in operation several years. At the entrance to the second adit is mill No. 2, which is practically a new plant. The two adits, nearly parallel to each other, are over half a mile apart and both cut the main vein at the same angle and on the same level, and at such depth as to give a great amount of stoping ground above the haulage level. The width of the main vein, which is called the Veta Verde, is stated to average about 15 m., the length of the ore-shoot being 2000 m. The gangue is quartz. That part of the property opened by adit No. 1 is known as the Dos Estrellas and that opened by adit No. 2 is called the Cedro. The ore from the Dos Estrellas carries 12 to 15 gm. gold and 200 to 240 gm. silver; that from the Cedro carries 10 to 13 gm. gold and 95 to 120 gm. silver. The ores from both parts are highly silicious. The silver is in the form of sulphide and chloride, as well as native; the gold is partly free and partly mixed with the silver sulphide. Besides the principal vein, the company has three other veins of sulphide ore. These are opened by cross-cuts driven from the workings on the principal vein. These sulphide veins are being developed, and the ore from them is now being milled. As this ore requires wet concentration, it is probable that a suitable equipment may be installed later. The mine is fully equipped with electric appliances, with transformers underground, the workings being illuminated by the electricity that comes from the Hecaxa falls, 300 km. distant.

The ores from the principal vein are crushed in stamp-batteries, classified, re-ground in tube-mills, and subjected to cyanide treatment for the extraction of the gold and silver. Mill No. 1 has 130 stamps, crushing the ore in a cyanide solution through 20 to 30-mesh screens. In passing from the batteries to the tube-mills the pulp is so classified as to separate the slime from the sand. There are 4 tube-mills in this plant, each 24 ft. long by 5 ft. diam., lined with El Oro ribbed lining, cast from chrome steel and scrap iron. It is stated that one set of such liners has been in use 11 months. The tube-mills reduce the pulp so that 75% of it will pass 80-mesh screens. This product is classified in cones, the overflow slime passing to agitating-vats, and the sand to the sand-vats for leaching. First the sand is given washes of 0.22% cyanide solution, then discharged into a second set of vats, in which is given washes of 0.4% solution, and this is followed by washes of 0.12% solution. In the slime treatment part of the decanted solution passes to the

zinc-boxes and the remainder is pumped to the return-solution vats that supply the batteries. The stamp-duty in this mill is 3.48 tons per stamp in 24 hr. Burt filter-presses are being installed here to handle the final slime. In this mill 43% of the material is treated as sand and 57% as slime.

Mill No. 2 has 120 stamps, crushing in cyanide solution. This is followed by classification, tube-mill pulverization, and cyanidation of the sand and slime separately as in mill No. 1. Here are 5 tube-mills in operation. They are the Allis-Chalmers type, 24 by 5 ft. The tube-mill product is divided as 36% sand and 64% slime. Of the sands, 57% will pass 80-mesh screens and 12 to 15% will pass 200-mesh. The sand, after passing to sand-receivers, thence to leaching vats, is first given washes of 0.4% solution, followed by washes of 0.12% solution. The sand is discharged by Blaisdell excavators and Robins conveyors. A 48-ft. tailing-wheel is being installed for elevating a portion of the material to be re-ground in the tube-mills. In this plant all the slime that overflows from the classifiers is treated to mechanical agitation and decantation in vats 36 by 10 ft. The discharge is run from these vats into others that are 36 by 20 ft., where the slime receives continuous agitation for 20 hr., thence to another set of vats 36 by 20 ft. in size, without agitators, for final settling. The Burt filters are also being installed in this mill. The stamp-duty in mill No. 2 is 3.55 tons per stamp in 24 hours.

The precipitate at mill No. 1 carries 75% metal, at No. 2 about 60%. In both mills they use 100 gm. of lead acetate per ton of ore and about 8 to 10 kg. lime. The cyanide consumption amounts to 1.33 lb. per ton of ore. An extraction of 88% of the gold and 64.5 % of the silver is obtained in mill No. 1; in mill No. 2 the extraction is 90% of the gold and 53.4% of the silver. This is for the first 11 months of 1907. Both mills are run by electricity.

The average operating costs per ton for the first ten months of 1907 are as follows (on 259,789 dry tons—the production for the 10 months):

	Pesos.
Milling	1.24
Cyaniding	1.70
Mining (including development at the rate of 1100 m. per month)	4.96
Assaying	0.07
General expenses	0.91
Taxes on ore	0.30
	9.18

The railroad from El Oro to the Dos Estrellas mills belongs to the Dos Estrellas company and is being changed to an electric line. The Dos Estrellas property belongs to F. J. Fournier and associates. On the operating staff are the following: Henri Bossuat, general manager; H. Jouanen, assistant manager; G. Gonzales and O. Lopez, mine superintendents; Walter Neal, superintendent of cyanide work; Thos. Dwyer, superintendent of mill No. 1, and W. H. Armstrong of mill No. 2.

In Colorado there are many occurrences of uranium ore in the form of carnotite.

The Prospector.

Enquiries sent to this department are answered free of charge, if submitted by subscribers who are not in arrears. The full name and post-office address of the sender must be given, otherwise no answer will be made. Those who are not subscribers must accompany their questions with a fee of $3 for each question. No assays are made.

F. A. M., of Murphy, sends a specimen of manganese dioxide, Psilomelane.

A small piece of black stalactitic Limonite was sent by G. E. W., of Los Angeles.

Quartz and Calcite or Dolomite stained by Limonite was sent by C. B., of Stemple, Montana.

The green mineral sent by A. C. R., of Lower California, is Garnierite, the silicate of nickel.

A rock containing small foliated plates of Molybdenite was received from G. B., of Goleonda, Nevada.

W. M. B., of Steamboat, Nev., sends a soft white hydrous silicate of aluminum, perhaps Allophane or one of the clays.

S. O. M., of Sweetwater, Nev., sends: No. 1, Tremolite; No. 2, Slate; No. 3, Basalt; No. 4 and 5, yellowish green Garnet; No. 6, Porphyrite.

E. E. N., of Nogales, Ariz., sends: No. 1, Granite; No. 2 and 3, coarse Granite or Pegmatite; No. 4, Syenite; No. 5, Hornblende-Diorite.

The three specimens of rock from Wallace, Ida., marked A, are: No. 1, Greenstone, quite chloritized; No. 2, Diabase; No. 3, Diabase with Asbestos and greenish Quartz.

Specimens sent by D. G., of Terrazas, Mex., are: No. 1, lost in transit; No. 2, mixture of Galena, lead carbonate, and Limonite; No. 3, massive Limonite; No. 4, rock with oxidized Pyrite.

The specimens sent by F. H. C., of East Auburn, were mainly schists containing Pyrite, and have become altered by the action of sulphuric acid formed from the decomposition of the pyrite.

The specimens sent by R. H. H., of Carson City, Nev., are: No. 1, green copper carbonate in a talcose rock; No. 2, specular Hematite; No. 3, Essonite-Garnet in rock with Gypsum; No. 4, Chalcocite and Chrysocolla.

R. I. G., of Fairview, Nev., sends: No. 10, Dolomite; No. 11, Diabase; No. 12, altered rock containing Limonite; No. 13, Hornblende-Andesite; No. 14, altered rock, perhaps an Andesite; No. 15, Melaphyr; No. 16, altered feldspathic rock; No. 17, Rhyolite.

Rocks from El Oro, Mex., marked R. R. M., are: No. 1, pyritic rock with greenish stains due to the protoxide of Iron; No. 2, Quartz-Breccia stained by Limonite; No. 3 to 7, lost in transit; No. 8, Chalcopyrite in quartz with Malachite and Limonite stains; No. 9, lost; No. 10 and 11, pieces from the oxidized zone of Chalcopyrite showing Limonite, Malachite, Azurite, and Gypsum.

MINING IN THE WRANGELL DISTRICT, ALASKA.

The copper prospects and gold placers of the Chitina valley, Alaska, were examined during the summer of 1907 by geologists of the United States Geological Survey. Most of these prospects lie north of the river, on the south slopes of the Wrangell mountains, extending from Kotsina river nearly to the head of Chitistone river, a distance of about 70 miles. Other prospects are located south of Chitina river, in the neighborhood of Taral, an Indian village on Copper river, but these have not yet received as much attention as those of the Wrangell mountains.

The gold placers in operation in the Chitina valley last summer are confined to Chititu and Dan creeks, two southern tributaries of the north branch of the Chitina known as Nizina river. Both creeks have been small producers for several years and promise to increase their output considerably during the coming season.

The Chitina River region was first visited by a Survey party in 1900, when a geologic and topographic reconnaissance map was made under the direction of F. C. Schrader and A. C. Spencer. The report on this work is now out of print. Later, in 1902, the western portion of the region, including only Kotsina river and Elliott creek, was visited by W. C. Mendenhall, whose report, entitled 'The Geology of the Central Copper River Region,' published as Professional Paper No. 41 of the Survey, is the only one still available for distribution. The explorations in 1907 in the Chitina valley were made by F. H. Moffit and A. G. Maddren, who spent about two months in examining the copper prospects and gold placers of the valley. Copper prospects exist at a small number of localities between Kotsina and Chitistone rivers near the contact of the Nikolai greenstone and the overlying heavy bedded Chitistone limestone. This contact can be traced with little difficulty, although it is in places covered by later sediments, and it has served as a guide for prospecting ever since the region was opened. The accompanying map shows the localities referred to.

Most of the ores of the Kotsina region are of one general type. Nearly all the workings, some of which are open-cuts and others short tunnels, show bornite, chalcocite, and, less frequently, chalcopyrite in greenstone. At one locality the copper ores are in limestone. The greenstone has undergone movements which have produced crushing and faulting but have not otherwise greatly altered the original condition of the rock, at least so far as can be seen in a hand specimen. A development of secondary minerals or of cleavage in the greenstone has taken place locally, however. The copper sulphides are present as lenses and stringers in the greenstone, and in most places occur in sheared zones of the rock or associated with joints and fault-planes.

All of the deposits examined by the Survey party on Elliott creek are of the type just described. They occur in the greenstone, many of them within short vertical distances of the Chitistone limestone. Nearly all the property, except a few of the easternmost claims, lie on the north side of Elliott creek and are controlled by the Hubbard-Elliott Copper Mine Development Co. In July ten men were employed on the property and were engaged chiefly in doing assessment work on unpatented claims and in building cabins for offices and quarters. It was expected to increase the working force and resume work on the adit known as the Elizabeth tunnel, which at that time had been driven a distance of about 250 ft. Short tunnels from 10 to 40 ft. long have been driven on several of the other patented claims, but no work has been done on them for some time, as, because of the very short season, the difficulty of procuring supplies, and the impossibility of making ore shipments until better transportation facilities are obtained, it has been necessary to devote all available time to representing the unpatented claims.

The most extensive operations on Kotsina river were under the direction of E. F. Gray of the Great Northern Development Co. About 75 or 80 men were employed in prospecting claims, most of which lie in the upper Kotsina valley in the vicinity of Ames and Roaring creeks. Some claims on Rock creek are also under the control of this company, as well as claims on Iron mountain south of the head of Elliott creek and near Kennicott glacier. No orebodies had been encountered at the time the Survey party left, though encouraging prospects had been found on Rock creek. Prospecting is carried on chiefly by tunnels in places where brown iron stains indicate the oxidation of sulphide minerals, and not less than a dozen of these tunnels have been started on the various properties. A small saw-mill erected last summer furnishes lumber for building and mining purposes, and during the early summer connection with the Government telegraph at Tonsina was established by a telephone line from the main camp on Kotsina river. A. T. Crawford had a small force of men doing assessment work on Khvesna river and several other tributaries of the Kotsina, such as Roaring creek and Copper creek. On Peacock and Surprise creeks the Alaska Kotsina Co. employed a small force of men in representing claims and in making improvements, such as building trails and constructing cabins preparatory to more active development next summer. The prospects are of the type common in the Kotsina region, except those on Shower gulch, where native copper occurs in an amygdaloidal greenstone.

Another company operating on the Kotsina is the California-Alaska Co., engaged like all the other operators of this region, in doing work necessary to hold claims. One claim on Copper creek is of peculiar interest, as it is one of the few in the western part of this Chitina belt where the copper minerals are found in the Chitistone limestone. Bornite with chalcopyrite, azurite, and malachite are the minerals seen in the surface openings on this claim.

From Kotsina river the Survey party crossed the high ridge on the south to the Kuskulana drainage. Most of the prospects of this locality are within a few miles of the glacier and include claims on Slatka, Trail, Dry, and Porcupine creeks as well as the

Kuskulana itself, but the most extensive operations were those on Nugget creek, on what are known as the McCarthy properties. With one exception the occurrence of copper here is of the same general type that is found farther west. All the prospects are in greenstone, and gangue minerals are generally absent except at the claim known as the Valdez. Here a short tunnel cuts a vein of calcite carrying bornite and chalcopyrite. The maximum thickness of this vein is approximately 24 ft., but it has been traced only a short distance along the strike in either direction. A number of claims have been staked in the somewhat isolated mountain mass between the Chokosna and the head of Gilahina rivers, but nobody was on the ground and the claims were not visited by the Survey party. Two groups of properties on Lakina river, known as the Greer and Lynch properties, differ from all the prospects to the west except those of Shower gulch in that most of the ore is native copper. The copper is associated with faults or joint-planes in amygdaloidal greenstone and, in places is contained in a quartz filling. Only assessment work has been done at this locality up to this time. A group of claims known as the Tjosevig is located on Hidden creek, west of Kennicott glacier. The copper minerals are chalcocite, bornite, and chalcopyrite in greenstone, associated with what may possibly be an intrusive sill. A small force of men was at work on these claims during the summer. A few miles farther south, in the main valley of the glacier, some prospecting was being done by the Great Northern Development Co.

The largest and by far the most valuable body of copper ore now known to be present in the Chitina valley is the Bonanza, which, with a few other claims of similar character, but of less evident value, constitute the property of the Kennicott Mines Co. The ore is almost entirely chalcocite and is a replacement of limestone along a series of perpendicular fractures or fault-planes. This orebody lies at an elevation of about 6000 ft. above sea-level. It is in the Chitistone limestone only a few feet above its contact with the underlying greenstone, but so far as is now known does not penetrate the greenstone. The fractures in the limestone have taken place with very little displacement and have not been traced downward into the greenstone nor can they be traced for more than a short distance horizontally. The ore is well exposed on the surface and has been cross-cut by two tunnels, but no further development work has been done on the orebody itself. The last summer was spent in preparation for active development work next year. A good trail was built from the mine to the mouth of National creek, where the office, quarters for men, and ore-bins are to be built, and thence down the east side of Kennicott glacier to Kennicott river. A wire tramway is under construction to carry ore from the mine to the bins, whence it may be transported to steamboats on Chitina river or to the railroad, when that is completed.

East of the Bonanza are the Nikolai property, on Nikolai creek, a tributary of McCarthy creek, and the copper prospects of Chitistone river and Dan creek. The Nikolai was the first claim patented in this region, and since the patent was granted no further work has been done. Two companies were prospecting on Chitistone river, and a number of persons were engaged in the same work or in representing claims staked in previous years. The Houghton-Alaska Exploration Co. is most active and has done more development work than all the others combined. On the north side of Chitistone river this company drove a 90-ft. tunnel in the greenstone and on the south side two short tunnels in the limestone just above the contact, to test the value of ores outcropping on the surface. The second company, the Alaska United Copper Exploration Co., employed most of its men in representing claims and in the construction of trails and a cabin. Among other properties that have attracted attention is the Chiti claim on Glacier creek, a tributary of Chitistone river. The ore is native copper associated with chalcocite and a little cuprite in amygdaloidal greenstone.

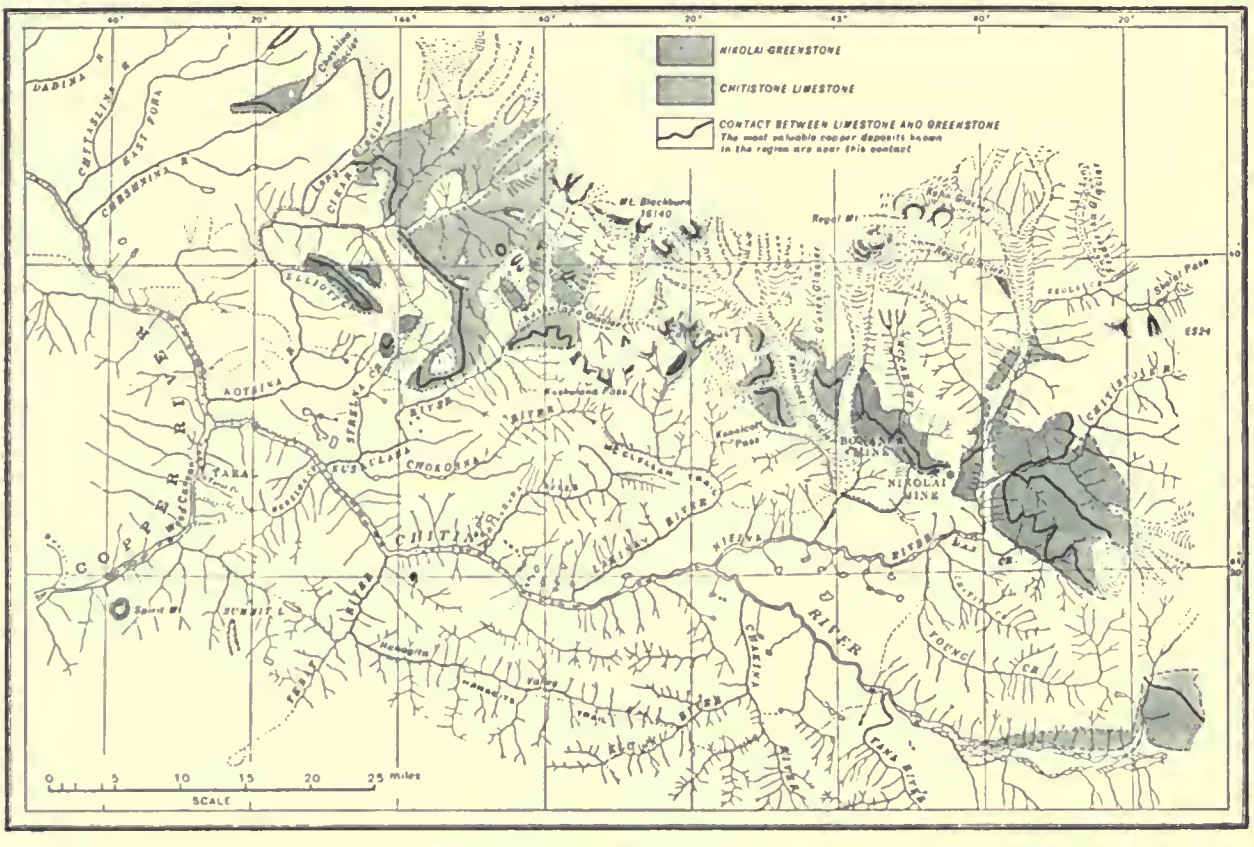
Placer mining in the Chitina valley is confined to Chititu and Dan creeks. Dan creek runs nearly parallel to Chititu creek and is only 6 or 7 miles north of it. The lower part of Dan creek is under a single control and is generally known as the Williams group. This ground has been well prospected and surveys for a hydraulic plant were made during the summer. Only a small amount of gold was mined this year, since the ground can be handled much more economically when the plant has been installed. Some gold was taken from Copper creek, the chief fork of Dan creek. On Chititu creek, G. M. Esterly has installed a hydraulic plant, which is in condition to begin active work as soon as the season opens in the spring. It includes, besides flume, pipelines, and the usual appointments, an electric-light plant and a well equipped saw-mill with planer, edger, and other appliances. This plant has been installed in an unusually business-like and efficient manner. Farther up on Chititu creek a hydraulic plant, the property of Frank Kernan, had a successful season.

The heaviest handicap under which prospecting has been carried on in all this interior country is the great cost of transportation. It is hoped that within the next two years, with the completion of the railroad, this difficulty may be removed. In July a small light-draft steamboat named the *Chitina* made her first trip from Abercrombie Rapids to Copper Center on Copper river and to the mouth of the Nizina on Chitina river. Most of the material for her construction was hauled in last winter over the snow from Valdez to the mouth of Tasnuna river, where she was built. She was completed in July, but after making one trip was hauled out on the river bank at Tasnuna. She will probably be used next summer in transporting supplies for the Copper River & Northwestern Railroad. This road is now being built from Cordova bay to Copper and Chitina rivers. From Abercrombie canyon a branch line will run to Katalla and the Bering River coalfields. The southern terminal of this railroad was recently changed from Katalla to Cordova bay, a

change which is probably due to the great difficulty of lightering freight from steamships at Katalla under present conditions and to the great cost and the long time required to build a breakwater behind which ships could lie at Katalla. Much prospecting and considerable development work has been carried on in the Prince William Sound country during the summer. Knight Island properties have been especially active for more than a year but it can not be said that a copper mine has yet been developed there. After Knight island, Latouche island and the Orca region have been most prospected.

Among the older properties, that at Ellamar has been idle during part of the summer, it is said because of labor troubles. During the summer the shaft was sunk to the 600-ft. level and 650 ft. of drift was made. The ore production, however, was much reduced. On Galena bay the erection of an aerial tram, 5000 ft. long, from the mine to the beach, was begun, and bunkers were being constructed at the beach. Only a little work was done on Bowlder bay, most of it by the Reynolds-Alaska Development Co., which extended its main adit. Two small shipments of ore, nearly 400 tons, were made by the Standard Copper Co. on Landlocked bay. A small shipment of high-grade ore was made from the Dickey prospects at the north end of the bay, where a tramway and wharf have been built. At Latouche, the Beatson property, known as the Bonanza and not to be confused with the Bonanza on Kennicott river in the interior, was the only property that made regular shipments. A cross-cut adit 900 ft. long was driven, cutting the orebody at a level 90 ft. below the old tunnel. The Reynolds-Alaska Development Co. has erected a wharf, electric-light plant, a trading store, and a number of houses on their property on Horseshoe bay, on the west side of Latouche island. A shaft was sunk on one of their claims and a small shipment of ore was made. East of the Bonanza mine, on the Barrack claims, active development work was in progress. A wharf, ore bunkers, and tramway were under construction and a small amount of ore was shipped.

A great many claims have been staked on Knight island, but most of the locations were made within a year or two, so that less work has been done here than on the neighboring island Latouche. Among those carrying on active development is the Hubbard-Elliott Co., whose property is on the west side of Knight island at Dryer bay. A tramway with other equipment was installed during the summer and a small shipment of ore is reported. Prince William Sound properties enjoy a great advantage over the interior region in that nearly all of them are within comparatively easy reach of tide water and that their development is not dependent on expensive railroad construction.



Map of the Copper River District, Alaska.

From Professional Paper No. 41, U. S. Geological Survey.

THE MINERAL PRODUCTION OF CALIFORNIA.—Some 47 mineral substances are now being mined in California, and the combined value exceeded $51,000,000 in 1906, and is estimated to be increasing at the rate of about $10,000,000 per year. The greatest recent advance in mineral production has been made in petroleum, an industry in which California now ranks second in the world. According to the best available statistics the output of California petroleum for 1906 reached the enormous total of 35,000,000 barrels, with a value of $10,000,000. Vast enterprises in pipe-laying are now in progress and some of them completed, for connecting interior oilfields with tide-water.

OIL INDUSTRY OF THE UNITED STATES.

Government Report on the Standard Oil Company.

The third report of the Commissioner of Corporations on the petroleum industry of the United States (which was submitted to President Roosevelt in August, 1907) has just been made public in a volume of more than 1000 pages. The investigation of the oil business by the Bureau of Corporations under the direction of the Secretary of Commerce and Labor was begun in the early part of 1905 by a corps of special examiners, attorneys, and agents under the supervision of Mr. Garfield, then Commissioner, and was completed in the latter part of 1906. Three volumes have been published:

(a) Transportation of Petroleum.

(b) Petroleum Industry, Part 1, Position of the Standard Oil Co.

(c) Petroleum Industry, Part 2, Prices and Profits.

The present review deals only with the last named report.

In his letter of submittal to the President, Mr. Herbert Knox Smith, the present Commissioner of Corporations, states that "from the point of view of the public, this is one of the most important parts of the report," previous parts having "had to do with means and methods," while "the present report on the other hand sets forth the results of such methods and the effect thereof on the consumer and on the profits of the Standard Oil Co." The Commissioner concludes that "The Standard is the most conspicuous example of a combination which maintains a substantial monopoly, not by superiority of service and by charging reasonable prices, but by unfair methods of destroying competition. * * * It has raised prices instead of lowering them. * * * Some of the unfair and illegal means * * * have been proved in the reports already published. * * * In the present report (it is established that) during the last eight years covered by this report (1898 to 1905) it has raised both prices and margins. * * * The Standard has superior efficiency in running its own business; it has an equal efficiency in destroying the business of competitors. * * * Its profits are far above the highest possible standard," on a reasonable commercial basis.

The report contains 736 pages, including 251 special tables and diagrams, following with 212 pages of general tables; the whole comprising an exhaustive argumentative study of profits and prices of the products of petroleum which, the Commissioner states, "is necessarily chiefly a study of the policy of the Standard Oil Co." The chief subject features are:

1. Crude oil; fields, prices, relation to supply of products.
2. Illuminating oil: sources of supply, distribution, prices.
3. Gasoline and stove oil; sources, importance, prices.
4. Lubricating oil for railroad equipment, methods, prices.
5. Margins between crude oil and its products.
6. Discriminations in domestic prices.
7. Foreign prices of American oil.
8. Profits and domination of the Standard Oil Co.

Of the six crude-oil fields the report says that only the Appalachian (or Pennsylvania, as it is better known) and the Lima-Indiana need to be considered for most purposes in the general discussion of price movements, for the reason that comparatively small proportions of the crude outputs of the other large fields are handled by the refineries; as shown by the following statement for the year 1904—a representative year:

Name of Field.	Total Crude Oil Produced. Bbl. of 42 Gal.	Consumed by Refineries. Bbl. of 42 Gal.	Illuminating Oil Produced. Bbl. of 50 Gal.
Pennsylvania	31,408,567	27,628,000	15,830,000
Lima-Indiana	24,689,184	24,230,000	8,700,000
Mid-Continent	5,617,527	1,056,600	370,000
Gulf	25,200,381	864,700	1,300,000
Colorado	501,000	440,000	125,000
California	29,649,434	4,167,000	650,000

The average annual price of Pennsylvania crude for about 20 years preceding 1898, with the exception of three years (1883, 1895, 1896) was below $1 per bbl.; from 1899 to 1906, both inclusive, the prices fluctuated from $1.21 in 1901 to $1.62 in 1904. The Lima-Indiana prices for the same period, 1898 to 1906, were from 61c. in 1898 to $1.16 in 1903. Previous to 1895 the price was below 50c. The report says that it is "probable that the Standard kept the price down in order to enable it to acquire extensive oil leases at a low price, after which it rapidly increased the prices. * * * There has been a marked similarity in the price movements between Pennsylvania and Lima crude during recent years." The Lima is not of as good quality as the Pennsylvania. The new field brought in about the close of 1905, in Illinois, and included in the Lima-Indiana field, has produced a refining oil about equal to the Lima, but the price has been much lower, due in part to the inability of the pipe-lines to handle the rapidly increasing production.

The Mid-Continent field has come to be a factor in prices of both crude and refined; but the report says that the general influence scarcely dates back of 1905, during which year a pipe-line was established from this field to Whiting. A separate report on the Mid-Continent field will be submitted by the Commissioner, owing to the complication and importance of the causes affecting the prices in Kansas.

In the Gulf field only the Corsicana district may be said to be controlled by the Standard in the fixing of the crude prices. A larger part of the crude in the southeast Texas and Louisiana districts is sold on the short contract basis, and prices are considerably lower than in Corsicana, whose product is largely consumed by the Standard refinery.

Colorado crude is chiefly consumed by the refineries that own the wells, and the products are marketed within a clearly defined area, so that the prices have substantially no influence on the prices of other crude oils or their products.

California crude has had substantially no effect on other fields or the general market, as only a small percentage is refined and there is such a variety of

quality, and variances in prices; and the products of the refineries are marketed within a sharply defined area. Five-sixths of the crude going to the refineries is treated by the Standard Oil Co. at Point Richmond. Owing to the peculiar conditions, particularly in connection with the fuel-oil business, California will require special discussion in a special report hereafter to be published.

"The yield of the crude is naturally an important consideration. * * * Hence the prices of Pennsylvania and Lima crudes are comparatively high and prices of Texas and California are relatively low. * * * Kansas crude occupies an anomalous position, having a high percentage of illuminating * * * yet it has been reduced recently to a very low price."

Following is a comparison of yields and prices in December, 1904, of the crudes in the five essential fields:

	Naphtha. %	Illuminating. %	Average Price. Per Bbl.
Pennsylvania	12	67	$1.57
Lima-Indiana	11.5	43	1.026
Mid-Continent	11	41	0.843
Gulf	3	15	0.311
California	6	18	*0.60

*Estimated.

The parallelism between the proportions and the prices is much closer in December, 1904, than in December, 1905.

Confining attention to Pennsylvania and Lima, the yield is about 3 to 2 in favor of Pennsylvania crude; the ratio of prices at the end of 1904 was nearly 3 to 2 ($1.57 to $1.026); at the end of 1905 the ratio of prices was about 9 to 5 ($1.58 to $0.915). So the ratio of yield between Pennsylvania and Mid-Continent was about 3 to 2 and the ratio of prices in December, 1904, was about as 9 to 5; and at the end of 1905 the price of Mid-Continent crude had declined to 52c. per bbl. and later to 39c.; meanwhile the Pennsylvania crude, although declining in 1905, was advanced in 1906 and reached $1.78 in 1907, while the Mid-Continent was advanced only 2c. per bbl.; and in the same period Lima-Indiana advanced; although in the beginning the Kansas crude was slightly higher than Lima, but in the middle of 1904 it dropped and then very rapidly until the price was less than half the price of Lima. Kansas was 35c. lower than Pennsylvania in February, 1903, and $1.07 lower in November, 1905; and in December, 1906, the margin was $1.19. "While the Standard may * * * have found the production greater than it could handle, nevertheless it has treated the Mid-Continent producers unfairly because it has used all its efforts to prevent independent pipe-lines and refineries from being established."

Further demonstration of the situation just described is made by a series of tables and diagrams regarding the comparison of the average annual stocks of crude with the average annual prices, and elaborated in the text. Briefly stated, the result shown is: "With the single exception of the movement from 1899 to 1900 * * * as the combined stocks (of the Pennsylvania and the Lima-Indiana fields) increased, prices decreased; and as the combined stocks decreased, prices increased" from 1894 to 1904. From 1904 to 1905 the price of Pennsylvania crude fell considerably, notwithstanding the decrease in the combined stocks of Pennsylvania and Lima-Indiana crude, due, probably, the report says, to the rapid increase in the stocks of Mid-Continent crude; which stocks had largely increased in 1904 also, but had no influence until 1905.

Sources of supply, distribution, and prices of illuminating oil are elaborately set forth in the report by maps, tables, and diagrams. The map of territorial distribution from Standard Oil Co. refineries indicates 17 refineries, which are here named in the order of their comparative sizes: Whiting, New York, Franklin, Philadelphia, Buffalo, Olean, Baltimore, Richmond, Cleveland, Lima, Pittsburg, Sugar Creek, Florence, Neodesha, Parkersburg, Chaison, Corsicana. The map shows six divisions of distribution, making two divisions of the Western (the Pacific Coast and Rocky Mountain divisions). Reading from west to east: The Pacific Coast is supplied from Richmond; the Rocky Mountain from Florence; Texas and parts of New Mexico, Oklahoma, Arkansas, and Louisiana, supplied from Chaison and Corsicana; Kansas, Nebraska, western Missouri, and western Iowa are supplied from Sugar Creek and Neodesha; the Central States, from Whiting and Lima and Cleveland; the Atlantic Coast States are supplied from the refineries of Buffalo, Olean, Pittsburg, Parkersburg, New York, Philadelphia, Baltimore.

From a table of prices of waterwhite illuminating oil, and cost of transportation, to retailers, by States and groups, the following is taken for the year 1904:

	Average Price per Gal. Less Transport. Cents.	Average Cost of Transport. Cents.
North Atlantic	9.5	0.5
South Atlantic	10.3	1.8
North Central	9.6	0.9
South Central	11.2	2.1
Western	13.7	3.1
United States	10.2	1.2

The table contains 49 prices and costs of transportation averaged from 1830 quotations. Some of the variations in prices of oil and cost of transportation between States are shown by the following selections from the table:

	Price per Gal. Cents.	Cost of Transport. Cents.
Delaware	7.7	0.7
Pennsylvania	8.7	0.6
Rhode Island	9.6	0.5
New York	10.0	0.3
South Carolina	10.8	2.5
Texas	11.6	1.5
Colorado	16.2	2.3
Nevada	16.4	5.6
Washington	15.7	2.7
California	11.1	1.2
Oregon	15.3	3.3

Data obtained from retail dealers show a predominance of tank-wagon delivery to the extent that of 3854 towns reported there were 3061 towns receiving oil in tank-wagons, and of that number the tank-wagon is used exclusively in 2517 towns; the next

important method is by iron and wooden barrels; while only 320 receive oil in cases.

Gasolene, next to illuminating oil, is the most important product of the refineries, the greater portion of which, particularly in recent years, has been either stove gasolene or motor gasolene. The report states that for December, 1904, price records were obtained representing 713 towns, mostly delivered by tank-wagons, covering the North Central, western South Central, Rocky Mountain and Pacific Coast divisions; full data for the Pacific Coast since 1897, and similar data from 1903 to 1905 for the Rocky Mountain division were secured from the Standard; these prices for the Western territory correspond quite closely to that of the North Central States, except that on the Pacific Coast the gross prices show less advance since 1903 on account of the establishment of the Standard refinery at Richmond, Cal. The North Central prices correspond also with prices in other divisions, and for that reason have been taken as typical of the movement of the entire country. The tables show the average price of gasolene, less freight, and the prices of Lima crude and of Pennsylvania crude, with the margin between the gasolene and the crude, demonstrating that in the period 1901-1905, particularly, there was a marked advance in the margin from January, 1901, to the middle of 1903 of 3.3c. per gal. (6.9 to 10.2); thence to the end of 1904 the margin declined 1.9c.; but in the first six months of 1905 the margin again ranges higher, increasing from 8.5 to 8.7 cents.

The significant feature of the lubricating oil industry presented by the report is the domination of the Standard Oil Co. in its dealing with the railroads. The report cites particularly the case of the Norfolk & Western Railway. This company, after making thorough and satisfactory tests of the relative efficiency of the lubricating oils of the Standard Oil Co. and two independent companies, and establishing the fact that the independents produced fully as good quality, and that one of them a preferable oil at a smaller cost, the Standard continued to control the sale of the lubricants to this as to other companies. The report goes into this matter fully, giving the record of the tests, the forms of contracts, and complete data. A tabulated statement is also given showing the wide difference in the net prices paid by different railroads.

Margins between crude oil prices and prices of products have increased since 1897, and added greatly to the profits of the Standard, according to the data in the report. It is shown that the average margin for all products combined for 1898 and 1899 was 6.1c.; for 1900 to 1902, 7.1c.; January, 1902, to June, 1905, 7.8c. It is possible, the report states, that some part of the increase in margins has been due to increased cost of pipe-line transportation, refining and marketing, but only a very small amount per gallon.

Discriminations in the domestic market as to prices in various cities are made a considerable part of the text and tabulated construction of the report. As an illustration the following prices, less freight, of illuminating oil in December, 1904, are given: New York, 10.5 cents per gal.; Boston, 10.8c.; Worcester, 7.5; Cleveland, 7; Cincinnati, 6.4; Augusta, Ga., 8.2; Atlanta, 10.9; Kansas City, 9.9; St. Joseph, 10.4; Los Angeles, 6.7; San Francisco, 12.3; Seattle, 14.5; Denver, 14.4; Butte, 16.6. Only a small fraction of these differences, the report says, is due to difference in cost. Referring to the differences in prices on the Pacific Coast, the Commissioner in his letter of submittal says: "One of the most striking instances is in California, where the Standard carries oil from its great refinery near San Francisco, several hundred miles by water and rail, and sells it in Southern California for several cents less than is charged for the same oil in San Francisco."

A very large proportion of the petroleum products of the United States, says the report, is exported; 55 to 60% of the illuminating oil is sent abroad; and that there is a remarkable excess in the American above the foreign price. During the latter half of 1904 the average prices were: United States, 10.3c. per gal. for illuminating oil; Germany, 6.92c.; United Kingdom, 6.42; Denmark, 6.49; after allowing 1 cent for difference in quality the excess ranged from 2.38 to 2.88c. That there was no oversupply in the United States, as claimed by the Standard, the report states was proved by the fact that the Standard shipped more than 2,500,000 bbl. of illuminating oil from Russia to various European and Asiatic countries, from November, 1902, to the end of the first half of 1905.

Two chapters of the report are devoted to discussion and data regarding the profits, and the sources of domination of the Standard Oil Co. It is shown that for the 25 years, 1882 to 1906, inclusive, the total amount of dividends paid was $551,992,904, an annual average of $22,077,000; and the average amount of trust certificates or stock was $91,434,574; the profits in excess of dividends for the same period amounted to $79,536,025; and these profits are based on an investment that at the end of 1906 was valued at about $75,000,000.

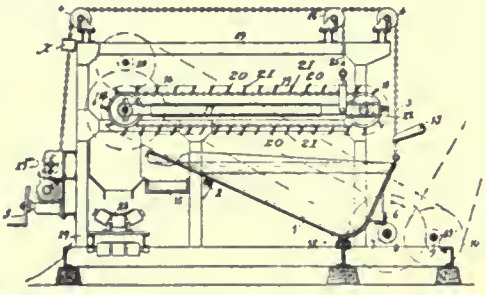
THEORETICALLY, a miner working underground requires only 6½ cu. ft. of fresh air per minute for respiration and the absorption of moisture and the dilution of carbonic acid gas. This assumes that air after having been breathed is immediately removed without mixing with the surrounding atmosphere, a condition impossible to fulfill. Considering that the permissible vitiation of air by carbonic acid is six parts in 10,000, it will be found necessary to provide 66 cu. ft. of air per minute to dilute and carry away the 0.8 cu. ft. of carbonic acid produced per hour by one man. Considering the problem in this light, it is evident that, although an average man at work breathes only about 750 cu. in. air per min., the amount necessary to carry away the gases given off is the important consideration.

A COMPANY formed at Nagasaki, Japan, for the employment of volcanic ashes for cement has realized great profits. Already the exports of this new kind of cement are not less than 700,000 bags per annum. It is shipped to Korea, Sciangai, Formosa, and north China. Sand and portland cement enter into the composition of the new material, but the proportions are not known.

MINING AND METALLURGICAL PATENTS.

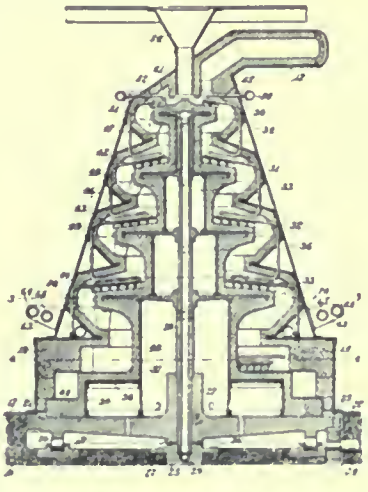
Specially Reported for the MINING AND SCIENTIFIC PRESS.

ORE CONCENTRATOR.—No.876,713; Petrus Härdén, Stockholm, Sweden, assignor to Metallurgiska Aktiebolaget, Stockholm, Sweden, a Corporation of Sweden.



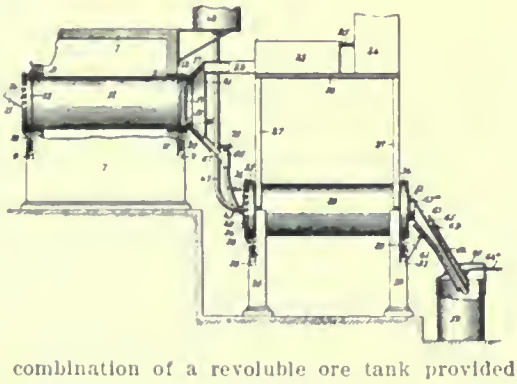
Apparatus for shaking ore pulp, comprising a pivoted receptable, means for shaking it, means for raising the receptable to run off the water, and an endless scraping means with devices for lowering the latter into the receptacle and withdrawing the same therefrom.

FURNACE FOR ROASTING ORES.—No. 876,567; Alva D. Lee, Brookline, Massachusetts.



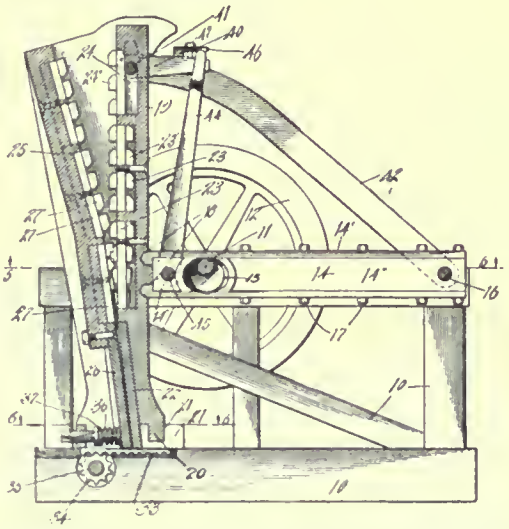
In a roasting furnace provided with an ore inlet at the top, the combination of a hollow revoluble member beneath said inlet; a plurality of projecting shelves secured thereto at various levels; a plurality of cylindrical casings surrounding said revoluble member between said shelves; and means for supplying heat to the bottom of said furnace.

REVOLVING ORE-TANK.—No. 876,539; Allen J. Garver, Clarkston, Wash., assignor to himself and Jonathan McAssey, Clarkston, Washington.



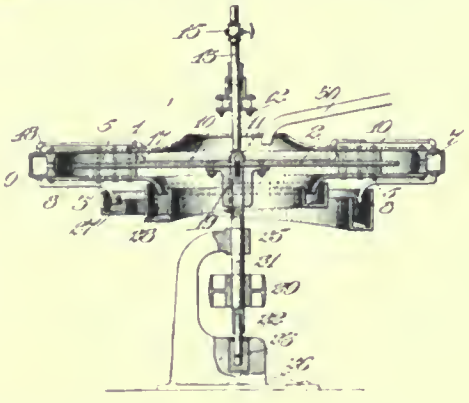
The combination of a revoluble ore tank provided with a disk, a pipe connected with said disk and adapted to discharge comminuted ores into said tank, said pipe being so connected with said disk as to permit the rotation thereof while said ore is being discharged thereinto, a second pipe connected with said disk so as to permit the rotation of said cylinder, said second pipe being adapted to discharge a solution into said cylinder,

ORE-CRUSHING MACHINE.—No. 876,892; John B. Albers, Los Angeles, California.



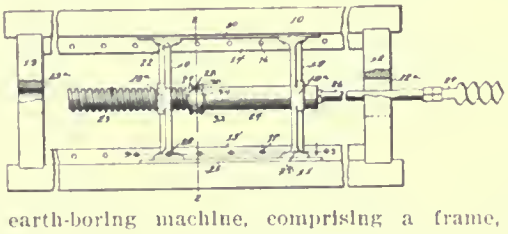
An ore-crushing machine provided with crushing jaws whose upper ends are more widely separated than the lower ends thereof; mechanism to give one of said jaws a vertical motion and the top of the other jaw a movement toward and from the jaw having the vertical motion; and mechanism to hold the lower end of said last jaw in spring pressed engagement with the bottom of the vertically moving jaw.

CENTRIFUGAL CONCENTRATOR.—No. 876,642; Edward Hearing and Fred A. Dudley, Kellogg, Idaho.



A concentrating apparatus consisting of a plurality of horizontally revoluble surperposed disks, independent separating chambers carried by the disks at the periphery thereof and having openings therelnto, each of said chambers consisting of a separate casting independently fitted to the apparatus, means for supplying the separable material to be dellvered outwardly by centrifugal force, and caused to pass over the openings into the separators, and pipes whereby water under pressure is dellvered into the separators so as to form a counter current through the receiving openings.

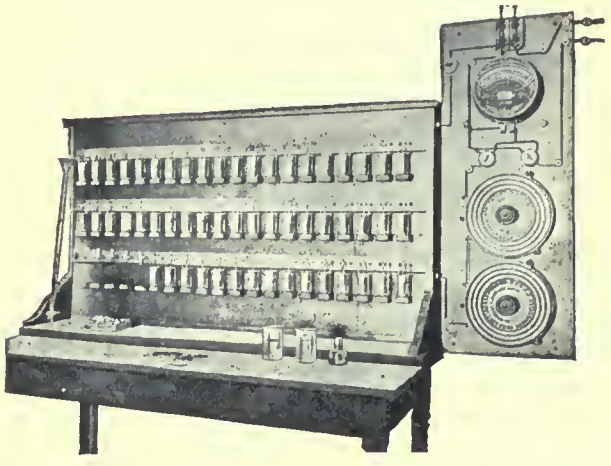
EARTH-BORING MACHINE.—No. 876,048; Patrick Fenton and Frederick W. Waechter, Knoxville, Iowa.



An earth-boring machine, comprising a frame, angle plates on said frame, connected machine heads in said frame and engaging said angle plates, a feed bar mounted in said machine heads, screw connections between said feed bar and one of said machine heads, means for connecting an auger to said feed bar and means for rotating said feed bar.

Electrolytic Assaying.

The increasing demand for greater speed and more accuracy in making daily assays of ores and products from mills treating material containing but very small quantities of lead and copper, has caused the older analytical methods to be supplanted by new ones, devised to meet the needs of modern work. The usual form of electrode in use at the present time consists of platinum cylinders and spirals, or cones and spirals, costing in the vicinity of from $15 to $20 each, making the installation of many units very costly.



In order to overcome this expense, George A. Guess and H. E. T. Haultain have designed and patented a cheaper form of electrode.

The outfits are furnished in cabinet form and can be made up of any number of units. In battery sets they are connected up in parallel and for power current they are connected in series. Suitable rheostats for controlling the current and also ammeters for reading are furnished with each outfit. The cost of the outfit complete for any number of units, including stand, table, batteries, ammeters, rheostats, connectors, beakers, and electrodes, will be found to be less than the cost of the old type of electrodes. In addition, the time necessary to make an estimation is a feature that most readily appeals to all operators, as determinations can be made in three hours, whereas in the old form from ten to twelve hours are necessary.

A pamphlet entitled 'Electrolytic Assaying' will be sent to all interested parties upon application to F. W. Braun, Los Angeles and San Francisco.

Books Received.

'Mining Tables' by F. H. Hatch and E. J. Valentine. Macmillan & Co. Price $1.90. 200 pages. This is a handy volume containing a comparison of the units of weight, measure, currency, mining area, etc., of different countries, together with tables, constants, and other data useful to mining engineers and surveyors. It is well worth the price and ought to prove most useful. For sale by the MINING AND SCIENTIFIC PRESS.

'Hydraulic and Placer Mining' by Eugene B. Wilson. John Wiley & Sons. Price $2.50. 350 pages. This is the second and revised edition of a popular handbook. It contains most of the information needed by those who wish to learn the rudiments of placer mining, while the book includes many data useful even to those who are experienced in this branch of mining. It is nicely illustrated and well printed. For sale by the MINING AND SCIENTIFIC PRESS.

'Specification and Contracts.' By J. A. L. Waddell. This useful volume includes examples for practice in specification and contract writing, together with notes on the law of contracts by John C. Wait. The publishers (The Engineering News Publishing Co.) state that the price of the book has been kept as low as possible, since their aim and that of the authors has been "the advancement of the engineering profession in one of its most important lines." It ought to be an extremely useful book of reference. Price $1. For sale by the MINING AND SCIENTIFIC PRESS.

Commercial Paragraphs.

WILLIAM W. POWER has recently been appointed manager of the electrical department of the Boston branch of the H. W. Johns-Manville Co.

THE GUTTA PERCHA & RUBBER MANUFACTURING CO. announces its removal on Feb. 1 from Alameda to permanent quarters at 67–69 First St., San Francisco.

THE CALIFORNIA ORE TESTING CO. is installing in this City a complete Merrill experimental filtering plant, consisting of slime-press and precipitation-press. Cyanide specialists should go and see it in operation.

THE AMERICAN WELL WORKS, of Aurora, Ill., have issued a new and attractive bulletin (No. 104), describing the construction of their centrifugal pumps and explaining the varied adaptations of this useful piece of machinery.

THE CHRISTMAN COMPANY, of Massillon, Ohio, has issued a well illustrated catalogue describing the special features of its drilling machinery and mine equipment; these include the hollow-rod drill, which has the motion of an ordinary churn-drill. In the rod next the bit there is a steel ball which forms a valve, and as the rod rises and descends, all the material is drawn into it and discharged at the top through the discharge hose.

Catalogues Received.

THE WESTERN ELECTRIC COMPANY announces a new bulletin describing the Beck Flaming Arc Lamps, now manufactured for use on either alternating or direct currents, and so greatly simplified in construction that but little skill is required in operating.

THE JOSEPH DIXON CRUCIBLE CO. of Jersey City, New Jersey, has issued a booklet entitled 'Dixon's Graphite Brushes'; this contains much information useful to all users of graphite brushes and will be of interest to many other mechanical and electrical engineers.

FORT WAYNE ELECTRIC WORKS of Fort Wayne, Ind: 'Bulletin No. 1102,' containing a list of plants operating direct-current direct-connected generators, types MP and MPL; 'Bulletin No. 1103,' describing the series A. C. arc lighting system; and an index to bulletins No. 1001 to 1103.

THE DE REMER WATER WHEEL CO. of Denver, Colo., has sent us the third edition of its catalogue entitled 'De Remer Water Wheels'; in addition to describing the water wheels manufactured by the company, it contains in tables much useful information for the hydraulic engineer.

THE A. LIETZ COMPANY of San Francisco, Cal., has issued the tenth edition of its 'Manual of Modern Surveying Instruments and Their Uses,' together with a catalogue and price list of the scientific instruments made by the company. The Lietz instruments are well known to the profession, having been made under the personal supervision of Mr. Lietz since 1882. They include the engineers' transit or theodolite, the Y-level, and the dumpy level; aluminum is largely used in the manufacture of these instruments. The manual also contains seven professional papers including 'A Short and Practical Treatise on Stadia Surveying or Trachymetry'; 'Remarks on the Principle of the Logarithmic Slide Scale'; 'Some Practical Hints on How to Tell a Good Surveying Instrument'; 'A Short and Practical Method to Find the Length of One Minute of Longitude in Any Latitude, Based Upon Certain Developments of the Terrestrial Spheroid'; 'The Cyclotomic Transit.' In short, this publication is not a mere catalogue, but contains much information of practical value to the engineer.

ROYAL SCHOOL OF MINES.—The annual dinner of the past students in the Royal School of Mines will be held at the Hotel Cecil, London, on March 18, at 7 o'clock. The chair will be taken by Mr. Richard Pearce, Ph. D., Past President of the American Institute of Mining Engineers. Tickets can be obtained from the honorary secretary, Mr. George T. Holloway, 57 Chancery Lande, London W. C.

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Editorial.

IN 1907, 5000 railway passengers and employees were killed and 6330 other persons, mainly trespassers on the right of way, were also killed, that is, a total of over 30 per day. In addition 76,286 were injured on our railroads in that one year. The waste of human life is more appalling than that of warfare; in the latter it is intentional, in the former it is due to bungling among the managers and lack of discipline among the employees.

READERS of this journal will be doing us a useful service if they will send photographic prints or 'kodaks' of scenes illustrating mines and mining operations in their vicinity, such as we have published recently in conjunction with the correspondence from Nevada appearing under 'General Mining News.' These little pictures are valuable in suggesting the general appearance and progressive development of our mining districts. The photographs should preferably be printed on glossy paper, for the dull artistic print makes a poor copper halftone.

PRICES OF METALS are higher at the present time than they were in the industrial depression that followed the panic of 1893. In February, 1894, the average price of copper was 9.6 cents; lead was 3.31; zinc, 3.85 per pound; and silver stood at 63 cents per ounce. Today they are 13½, 3.75, 4.80, and 57½, respectively. Only silver is lower than in 1894; copper is 40% higher. But wages and supplies of every kind are much higher, we have all profited so much by the rise that relatively we feel the fall all the more, for our standard of living, whether in the home, or the shop, in the mine or the smelter, has reached the mark of extravagance. It costs 20 to 25 per cent more to extract the metals from the ground and it takes 20 to 25 per cent more for the miner and smelter to pay their bills than 14 years ago. The more we remember, the less we forget.

NEWS of the doings of professional men is always interesting to their fellow practitioners; hence the column devoted to 'personals' is widely read. In this issue we announce the retirement of Mr. H. C. Hoover from the firm of Bewick, Moreing & Company. This has been rendered necessary as much by the need of rest as differences of opinion. Mr. Hoover has been a tremendously active man for the last ten years and we are glad to think that he will not sacrifice his youthful manhood to the relentless pursuit of wealth. It will interest our readers to learn that in the 30 years previous to 1902, the largest number of working mining concerns associ-

ated with the firm of Bewick, Moreing & Company was 15. These were, in 1901, handling about 500,000 tons of various stuff and earning a profit of about £500,000. In 1907 the business had grown so as to include 45 concerns, handling 3,250,000 tons, earning about £1,600,000. These facts afford testimony to the industry and ability of the firm, and, we believe, especially to such qualities on the part of our friend, Mr. Hoover. We hope his holiday will bring him to California, for he is a graduate of Stanford University and one of the many engineers to whom this State has proved a real school of mines.

National Mining Bureau.

ON ANOTHER PAGE we give the text of a resolution introduced before the Congress of the United States in relation to the plan of establishing a mining bureau at Washington. The Committee on Mines and Mining has reported favorably on the proposal to create a branch of mining technology in the Geological Survey, but it has not yet endorsed the bill to establish a Bureau of Mining Technology in the Department of the Interior, separate from the Survey bureau. Senator Heyburn's bill expressed the desires of the Western men who have been agitating for a mining department for many years, but the radical legislation therein demanded did not find favor with the Committee on Mines and Mining. Senator Dick's resolution obtained the support of the friends of the Survey, mainly on the argument of Mr. Tillman, that it could be easily passed by the Congress, while the establishment of a separate bureau would require a hard fight. The sentiment of the Committee was unanimous that the proposed Division of Mining Technology in the Survey was to be regarded merely as a first step toward an independent bureau, but they were not then ready to endorse the recommendations of the Secretary of the Interior. We deem it proper to state that the officers of the Geological Survey are not to be blamed for the outcome, disappointing as it is. The director, Mr. George Otis Smith, has stated frankly that he favors "an increase in the mining work by the Federal government without duplicating that already authorized." As a matter of fact, the sentiment of the Survey people is for the Dick bill, which, on account of its brevity, offers fewer points for attack than the bill introduced by Mr. Englebright, as published in the MINING AND SCIENTIFIC PRESS of January 18. It is best to make the general law brief and simple, and to have it deal with principles only. Adequate protection against a wrong interpretation lies in the necessity each year of getting specific appropriations for carrying out the work. There is much good sentiment at the back of this movement for a bureau, especially as it relates to the investigation of mining accidents, and it is hoped that the Dick bill will be passed. The resolution introduced by the same senator is practically an endorsement of the work already undertaken by the Survey, which has wandered far from the field of activity for which it is best fitted, however excellent the motive prompting such departures. We hope most sincerely that the agitation for a National Mining Bureau will not end simply in legalizing the non-geological labors of the officers of the Survey, enlarging the bureau of geology so as to include subjects quite outside the special training of a geologist. The service to be done by a Bureau of Mining may be uncertain, the excellence of the geological investigations made by the Survey has been demonstrated beyond argument; let us not graft a new branch on a fruitful tree.

The Lead Market.

WE LEARN FROM AUSTRALIA that the idea prevails there that the lead market in San Francisco is badly congested. This is far from being the case. The Selby smelter, which is the controlling factor in regulating prices on the Pacific Coast, has only eight or nine hundred tons of 45 per cent concentrate on hand and is barely able to supply local needs. Early in January a shipment of lead amounting to 1500 tons was made to New York and that pretty well depleted the stock on hand. On the contrary, the chief depressing factor at the present time is the accumulation of lead concentrate at Port Pirie, in South Australia. We are informed that this stock, from the Broken Hill mines, amounts to about 50,000 tons. The concentrate was purchased by the European ore-buyers when lead stood at about £22 per ton (4.75 cents per pound); and the total accumulation, including zinc concentrate, amounts to 70,000 tons. The Australian situation is critical, for the ore-buyers will not take lead concentrate on the old terms, namely, for from 6 to 12 months, and at a charge of from 80 to 90 shillings, but they insist on contracts for a period of 5 years and a rate, including all deductions, of about £5½. Apparently, the buyers are unwilling to accept any more lead, even on their own terms, until the existing surplus has been consumed. Large sums of money must have been lost by some of the contracts made by metal merchants: for instance, in one or two cases at Broken Hill, a long contract was made on a charge of 82 shillings; this contract is still in effect and it was in effect when lead sold at about £14 per ton; in the interim the metal went to £22, and is now back to £14 again, so that several firms lost heavily by these transactions; it is not strange that they are extremely cautious now. On the other hand it is hard on the Broken Hill mine operators to have to pay an increased charge of about 30 shillings, or $7.50, per ton. But that is the experience on this side of the equator also. It is the old question as to who is to bear the loss due to falling prices; obviously it should be shared by the producer, the consumer, and the middleman. Of course, part of the trouble at Broken Hill, as elsewhere, in so far as concerns lessened profits from lead mining, is due to the advance in wages. At Broken Hill the increase amounts to 12½ per cent and even this figure does not give the full measure of extra cost to the producer, for besides the higher rate the operator faces diminished efficiency. In times of intense industrial activity when workmen are scarce

and unions exacting, not only are wages higher but poor workmen cannot be dismissed advantageously, for they are likely to be replaced by others that are no better. The men know that they are in demand and they abuse their advantage. Then comes a time of reaction; wages fall; men are idle; and the whole clumsy arrangement is re-adjusted. During the boom, the employee has the upper hand; when the depression arrives, the employer is the arbiter. It is a pity; apparently it is an essential part of a brutal cosmic process that the interests of the two sides should be antagonistic and they will remain so until a higher order of intelligence directs the actions of both the elements involved in our complex industrial civilization.

A Professional Blue Book.

SEVERAL of our professional friends have received a letter from Mr. H. M. Chance, of Philadelphia, inviting them to join him in the formation of a Mining and Metallurgical Association, the aim of which is to "promote and maintain the dignity and advance the interests of these professions by all means, and to perform functions covered by neither the American Mining Congress nor the American Institute of Mining Engineers."

It is fair to state that Dr. Chance is an engineer in excellent standing, an old assistant of Lesley, and a gentleman quite warranted in taking a lead in such matters. Next, we may quote from his letter a paragraph outlining the nature of the work to be performed by this Association; he says: "As one of the objects sought to be attained is the protection of the public and of the profession, by such measures as may be practicable, from the damage done both by charlatans posing as engineers and experts, it is proposed that the first work undertaken by the Association shall be the compilation of a directory, or Blue Book, of those legitimately engaged in mining, metallurgy, and allied industries and occupations, including all those, whether technically educated or not, who by experience may be qualified to render useful service in any particular class of work. It is proposed to insist upon rigid classification, precisely defining the character of services each is best qualified to perform, as indicated by the provisional list herewith enclosed, thus providing a means of discriminating between those who are and those who are not qualified to render useful service in these pursuits." Further on, he explains that "the responsibility for the exclusion of names from this directory will be assumed by a Board of Censors, elected by the Association."

Thus at last we shall know who is a mining engineer in good standing and the public will be told, by process of elimination, whom not to engage professionally. Speaking seriously, we have no hope that such a purpose can be accomplished; there is no probability that any group of men however representative could, or would, exercise judicial functions, separating the sheep from the goats, the respectable engineers from the charlatans or the has-beens, any more than the Mining Congress or the Institute. In the first place, some of the leading men in the profession would have to be excluded as being promoters who use the services of mining engineers rather than doing the work themselves. So also there are those who were once metallurgists and are now manufacturers and financiers; such men are no longer metallurgists. A clergyman who has unfrocked himself voluntarily, to become a stock-broker, ceases to be a priest; a man who formerly designed houses and who has retired to a farm is no longer to be rated as an active member of the profession of architects. Secondly, men are not fixed quantities; one who is sufficiently trustworthy and careful today to be in the Blue Book, may be guilty of the worst errors five years hence, through the undermining of his character by drink or greed; a poor fellow who erred yesterday and is today deemed unfit for a responsible position—or to be in the Blue Book—may pull himself together so as to be a first-rate engineer ten years hence. Let any man of twenty years' experience look over his acquaintances and he will be able to give names to fit the above descriptions. In a field of activity that is world-wide and amid the extraordinary changes of environment that befall the members of our profession, the ups and downs of moral assessment are tremendous. No Board of Censors could keep in proper touch with the fluctuating value of the human integer, for to no such body of men would all the necessary information be available. Take a practical example: We have 'Who's Who in America.' This is a 'blue-book' of men of standing and it is one of the best of its kind, but any familiarity with the contents of this directory of notabilities soon dissipates the idea that it is more than a useful volume of reference so far as it goes. No one would claim that it affords a complete list of the leading men of America today, for, to mention only one feature, it is predominantly filled with the biographical accounts of professors and writers, in fact, the sort of people that occupy an official position in the community by teaching or those that obtain a varying kind of prominence by writing; and all these people put together would not begin to represent the sum of American professional, financial, or industrial talent. In fact, this imitation at long distance of a Burke's Peerage is, in a democracy, bound to be a little ridiculous. You can rate men by rank in countries where a College of Heralds occupies itself with sifting the data necessary for the purpose; you can decide whether a man is of baronial birth or not, if you have his pedigree, because the question of his personal character or ability does not come into the question. But when you start out to decide the relative worth, professional attainments, or business fitness of the individual, you usurp a function that only omniscience can properly perform. We hope, therefore, that Dr. Chance and his friends will abandon the more ambitious feature of their undertaking and be content to publish a directory of those professionally engaged in mining and metallurgy, leaving the final appraisal of worthiness to that high tribunal to which a man is called when the last order comes, 'Lights out.'

Personal.

COURTENAY DE KALB is here from Los Angeles.

WILLIAM DE L. BENEDICT is here from New York.

JAMES C. SPERRY is in San Francisco for a few days.

E. GYBBON SPILSBURY sailed for London on February 4.

H. KILBURN SCOTT has returned to London from India.

SIDNEY E. BRETHERTON, of Redding, has gone to New York.

PHILIP L. FOSTER was recently in London, from New York.

F. W. OLDFIELD is examining prospects at Rawhide, Nevada.

J. W. MERCER has returned from Ecuador, and is now at Denver.

ROBERT M. RAYMOND is returning from London to El Oro, Mexico.

HERBERT HAAS, of the Union Iron Works, has gone to Goldfield, Nevada.

ERNEST LEVY is temporary manager of the Le Roi No. 2 at Rossland, B. C.

SEELEY W. MUDD returned recently from a trip to Europe. He is now at New York.

OTTO SUSSMANN returned to Salt Lake last week from examining mines in Idaho.

GEORGE MOORE of the Moore Filter Co., New York, was in Salt Lake City last week.

JAMES W. LONG, formerly at Ouray, and lately in Nevada, is on a visit to San Francisco.

H. D. PALLESTER, of Terlingua, Texas, is visiting the quicksilver mines of California.

SCOTT TURNER has gone to Tacoma, to superintend sampling operations at the smelter.

W. J. PENTLAND is general manager for the Campañia Minera, Juarez, in Sonora, Mexico.

JOHN L. HENRY, of Oakland, has gone to northern Mexico, to examine a group of gold mines.

JOHN A. REID sails on the *Curaçao*, leaving on February 15, for Triunfo, in Lower California.

J. E. SPURR and W. ROWLAND COX have formed a partnership, with offices at New York and Denver.

J. H. VAN DENBERGE, whose office is at 74 Broadway, New York, is now examining mines in Colorado.

LLEWELLYN HUMPHREYS is consulting engineer for the Gunn Thompson Co., operating at Ely, Nevada.

EDGAR NEWHOUSE, of the American Smelting & Refining Co., is in San Francisco, on a tour of inspection.

CHARLES A. SHELBY is superintendent of reduction division for the Cananea Consolidated Copper Co., in Sonora Mexico.

R. C. SHAW was very ill in Costa Rica and had to return invallded. He is now recuperating his health in South Carolina.

W. A. REED, formerly with Liberty Bell Co., at Telluride, is manager of the W. P. H. Leasing Co. at Cripple Creek, Colorado.

JOHN HAYS HAMMOND underwent an operation for appendicitis in San Francisco on February 12, and is recovering satisfactorily.

Owing to ill health brought on by overwork, H. C. HOOVER is retiring from active partnership in Messrs. Bewick, Moreing & Co., and W. J. LORING takes his place as technical head of the firm. Mr. Hoover is retained by the firm for general advice and at the request of the boards of directors of various companies retains his seat as a director.

ROYAL SCHOOL OF MINES.—The annual dinner of the past students in the Royal School of Mines will be held at the Hotel Cecil, London, on March 18, at 7 o'clock. The chair will be taken by Mr. Richard Pearce, Ph.D., Past President of the American Institute of Mining Engineers. Tickets can be obtained from the honorary secretary, Mr. George T. Holloway, 57 Chancery Lane, London W. C.

Latest Market Reports.

LOCAL METAL PRICES—Feb. 13.

Antimony	12@16c	Quicksilver (flask)	$45@45.50
Casting Copper	17½@18½c	Spelter	6½@ 7¼c
Pig Lead	4.10@ 5.05c	Tin	33@34½c

ANGLO-AMERICAN SHARES.
Cabled from London.

	Feb. 6. £. s. d.	Feb. 13. £. s. d.
Camp Bird	0 16 0	0 15 6
El Oro	1 0 7½	1 0 0
Esperanza	1 2 6	1 2 6
Dolores	1 8 9	1 7 6
Oroville Dredging	0 12 6	0 12 6
Stratton's Independence	0 2 9	0 2 9
Tomboy	1 7 6	1 7 6

(By courtesy of W. P. Bonbright & Co., 24 Broad St., New York.)

MINING STOCK QUOTATIONS—NEW YORK.

	Closing Prices. Feb. 13.
Bingham Central	½
Boston Copper	14⅜
Cumberland Ely	6¾
El Rayo	1⅝
Guanajuato Con	2
Giroux Con	3¼
Nevada Con	9⅝
Nipissing	6¼
Tennessee Copper	24¼

(By courtesy of Hayden, Stone & Co., 25 Broad St., New York.)

METAL PRICES.
By wire from New York.
Average daily prices in cents per pound.

Date	Electrolytic Copper	Lead	Spelter	Silver
Feb. 7	13⅝	3.75	4.73	56⅞
" 8	13½	3.75	4.75	56½
" 9	Sunday.	No market.		
" 10	13½	3.75	4.77	57⅜
" 11	13⅝	3.75	4.80	56¾
" 12	Legal holiday.	No market.		
" 13	13¼	3.75	4 82	57¼

COPPER SHARES—BOSTON.

	Closing prices. Feb. 13.		Closing prices. Feb. 13.
Adventure	2¼	Michigan	10
Ahmeek	55	Mohawk	49
Allouez	26½	Nevada Con	9½
Amalgamated	47⅝	North Butte	42
Arcadian		Old Dominion	33½
Atlantic	10	Osceola	78
Balaklala		Parrot	12¾
Bingham Con	5¼	Phœnix	1
Boston Con	14⅞	Quincy	80
Butte Coalition	17⅛	Raven	
Calumet & Arizona	106	Rhode Island	3½
Calumet & Hecla	835	Santa Fe	2⅛
Centennial	21	Shannon	10⅜
Con. Mercur	35	Superior & Pittsburg	11⅞
Copper Range	56½	Tamarack	62
Daly-West	8¾	Trinity	13
Franklin	8	United Copper com	6
Granby		Utah Copper	23½
Greene-Cananea, ctf	7¾	Victoria	4½
Isle Royale	19¾	Winona	
Mass	3½	Wolverine	125

SOUTHERN NEVADA STOCKS.
San Francisco, Feb. 13.

Belmont	1.40	Montana Tonopah	1.90
Florence	4.30	Nevada Hills	2.95
Goldfield Con	4.80	Tonopah Extension	1.30
Laguna	1.00	Tonopah of Nevada	5.25

(By courtesy of W. C. Ralston, 353 Bush St.)

Obituary.

FRANCIS T. FREELAND died at Philadelphia on January 27. He was staying at the Colonnade hotel and is supposed to have succumbed to apoplexy. He ranked high in the profession. Born at Philadelphia and a graduate from the University of Pennsylvania in 1879, he early developed skill as a mathematician. Going to Colorado, he became manager for the Iron Silver Mining Co. at Leadville, then he was successfully engaged at Aspen, and still later he was manager of the Isabella mine at Cripple Creek. He contributed several important papers to the Transactions of the Institute, notably one on faulting, and was a leading expert in mining litigation. For the last five years he had practically retired from professional practice. He had just returned from a journey round the world when he died. He was never married, but had many friends.

General Mining News.

ARIZONA.

COCHISE COUNTY.

The Big Springs Mining Co. has 10 men stoping ore in a 165-ft. adit of the Claire mine; this ore is mostly of the silver-lead class, but in one place the lead is replaced by copper. All of the ore carries gold, several assays indicating 1 to 4 oz. per ton. Several smelter shipments show that the ore averages at least $30 per ton in lead, silver, and gold. C. W. McCoy is manager.——Supplies are being forwarded to the property of the Lutz Mines Co., in the Huachuca mountains; H. J. Amphlett is superintendent. ——The owners of the Savage mine are preparing to install a heavy hoisting plant, sink a new working shaft, and build a concentrating plant.——The Paradise Mining Co. is sinking a shaft which is to be 250 ft. deep.——At the King of Lead mine three men are working; they are making occasional small shipments of ore.——At the mine of the Bisbee-Sonora Mining Co., in the Paradise district, an adit has been driven 182 ft. to develop the Badger-Hail lode; it has cut the vein and the entire breast except a few inches in one corner is ore carrying silver, lead, and copper. The vein is over 60 ft. wide at the surface.

GILA COUNTY.

It is reported that the Keystone and Live Oak mines will pass into the possession of a New York syndicate.

GRAHAM COUNTY.

Rich gold ore has been found in the bottom of the shaft of the Old Gold Belt mine in the Clifton district.——Development work at the New York-Arizona property continues to reveal a fair grade of milling ore.——Walter Doudna, who has a bond on the Gypsy Queen and several other claims in the Greenelee district, has let a contract to W. S. Riley to drive a 75-ft. adit on the Gypsy Queen claim. ——E. Depee reports that he is mining excellent silver ore at the Harper mine near Morenci.——The Arizona Copper Co. has produced 1441 tons of bessemer copper during January; several new converters and a number of converter tops have arrived from the El Paso Foundry & Machine Co.——C. D. Cameron in developing the Celtic group of claims near Metcalf, has found sulphide ore, averaging 28% copper and carrying some gold and silver. A small pumping plant is to be installed.

MOHAVE COUNTY.

(Special Correspondence).—The Smith-Shaefer group of claims was sold last week for $65,000 cash to Kingman and Eastern parties; the sale was effected through W. O. Young of Salt Lake. The property is near Chloride.

Kingman, Feb. 7.

PINAL COUNTY.

Plans are being matured for the erection of a more extensive plant at the Sultana-Arizona mine; this is to include a power plant, tram, concentrator, compressor, and other machinery. A good force of men is employed doing extensive development work. The company has shipped 16 carloads of ore that carried, according to smelter returns, 10 to 20% copper. Several more carloads of ore are on the dump ready for shipment. John Mecham is president of the company.——T. H. Crowe purchased a stamp-mill and was preparing to erect it at Troy when the financial panic tied up his funds in the Globe National bank.—— The new smelting plant of the Southern Arizona Smelting Co. at Sasco, was blown in on Feb. 1 and is running satisfactorily. It is a thoroughly equipped plant, with at present one furnace of a daily capacity of 350 tons, but another furnace of equal size has been ordered. The smelter was built primarily for the reduction of the ore of the Imperial mine, 12 miles south of the smelter, but later will handle custom ores if they are offered.

YAVAPAI COUNTY.

The smelter company at Humboldt is settling local bills, including taxes, and preparing to start up.——The new perpendicular shaft at the Logan mine, 4 miles southeast of Skull Valley station, is 115 ft. deep; it exposes ore the leanest of which assays 3% copper and $1 gold per ton. The mine is opening a belt of sulphide-bearing schist whose outcrop is 250 ft. wide. Water is piped to the camp from a spring on one of the claims; a sufficient supply can be developed for a large reduction plant. W. J. Casey is foreman at the mine.——The Redmen Mining Co., whose property is near McCabe, has purchased a 5-stamp mill, air-compressor, and two power drills.——It is said that the Logos Mining Co., operating in the Bigbug district, has developed an orebody 26 in. wide, consisting of chalcocite ore carrying 20 to 40% copper.——A 12 hp. gasoline hoisting plant is to be erected at the Critic mine near Wendendale; this mine is being operated by Loftus & Davis.——C. B. Genung has uncovered a rich gold-bearing vein on his property near the Congress Junction road; it is exposed in a 40-ft. shaft that was dug years ago.——The Cardinal Mining Co. has sufficient ore in reserve in the Express mine for a long mill run; it is to be crushed at the mill of the Arizona M. & M. Co.——At the Mescal mine in the Jerome district two shifts of men are driving an adit and it is stated that another shift will be added as soon as practicable.——Work has been abandoned at the Boston Jerome mine until a power hoisting plant has been installed.—— At the Verde Grande mine the shaft is 510 ft. deep; sinking has been stopped for the purpose of cutting a station.—— The Haynes Copper Co. is installing the machinery necessary for the sinking of a shaft over 1200 ft. deep.

CALIFORNIA.

BUTTE COUNTY.

Blue ground was struck on Feb. 5 at a depth of 92 ft. in the drill-hole being sunk at the diamond mine. This blue ground was drilled into about 10 ft. and sufficient samples obtained to show that the formation is identical with that in the main shaft on the property. The drill will now be moved to another portion of the ground, as the object of the drilling is to determine the extent of the so-called 'kimberlite' deposit.

CALAVERAS COUNTY.

It is reported that the management of the Melones mine is seeking a crew of men who speak the English language. ——Sam Davidson found $160 worth of gold nuggets in the course of a day or two of panning on ground near the old Boston quartz mine. This ground was worked years ago by Frenchmen, but it now appears that there may be several acres of virgin ground.

EL DORADO COUNTY.

The preliminary work at the Bean Hill hydraulic mine is completed. The company has a fine debris dam. One of the Debris Commissioners examined several dams in the vicinity of the Bean Hill mine and selected sites for several more dams.——W. Dean and son are busily working their hydraulic mine.——It is proposed to begin work shortly at the Stillwaggon mine; W. L. Rees is to be superintendent.

INYO COUNTY.

A vein 2 ft. wide has been uncovered on the Poppy group of claims at Skidoo. The find has created excitement in the camp because a sample from half the width of the vein assayed $1568 per ton and a sample from the remainder assayed $261 per ton. Walter Wright, S. W. Cline, and J. Frank are the owners.——At the Skidoo company's property, the main shaft is 400 ft. deep and between 4000 and 5000 ft. of development work has been done, not counting lessee's operations. There have been developed three veins 1 to 3 ft. wide of relatively high-grade ore. One of them which is 2 to 2½ ft. thick has been exhaustively sampled and is said to carry $68 per ton. The construction of a mill is in progress.——Work is being pushed on the Yellow Garter group of claims and it is now thought that the Gold Standard lode has been found on it.——The final touches are being put on the Casa Diablo mill and on the repairing of some electric transformers that were unable to withstand a test. Development work in the mine has

exposed an orebody 40 ft. long and 28 in. wide; this ore is said to carry $100 per ton.——Samples from the 700-ft. adit of the Dunlap mine assayed $5.47 per ton; they were from the country rock and the vein has not yet been reached.——The erection of the new 30 stamp mill for the Snow Canyon company is proceeding rapidly.

NEVADA COUNTY.

Work at the Normandie mine is being pushed with vigor; the shaft has been unwatered and sinking has been begun. ——Owing to the financial state of the country only a few men are employed at the Norambagua mine; Richard White is superintendent.——The Greek lode has been cut in the cross-cut of the Union Hill mine; it is 2 ft. wide and contains free gold plainly visible. The same company has a shoot of high-grade ore in the Wiltsee vein.——The long drainage and transportation adit project known as the Twin City Subway is slowly making headway toward organization. The promoter, George Downey, has not met with any opposition of property holders on the route selected by him, and is receiving encouragement from the owners of the mines that will come within the sphere of benefit of the long adit.——At the Idaho Maryland mine 10 stamps are crushing ore from the 500-ft. level; the ore-shoot has now been opened for 100 ft. and it is 18 in. wide. ——Negotiations are in progress for the sale of the old Pittsburg quartz mine on the Gold Flat slope of the Banner Mountain ridge. This mine is developed by a shaft 1000 ft. deep; the lode varies from 6 in. to 4 ft. wide. Some of the ore carried from $50 to $350 in gold and silver per ton. The vein at the Brunswick mine is 18 in. wide; the company paid one dividend and made many improvements while working out a block 250 ft. high and 450 ft. long.

PLACER COUNTY.

At the Southern Cross mine all repairs have been made and things are ready for a good run. The 20-stamp mill will be started shortly and the crew of 12 men will be increased to about 25; James H. English is superintendent. ——M. Savage has a small force of men developing the Three Queens mine; he is opening an ore-shoot that years ago yielded $14,000 from a piece of ore the size of a parlor stove.——The Crater mine has been drained and everything is in readiness for driving on the 800-ft. level.—— Lee McCoy has struck a 'white channel' at the Vier mine on Georgia hill.——The Cash Rock dredge has been completed; the suction pipe can take up and throw off a boulder 9-in. diam. An oil-tank of 80,000-gal. capacity is being built on the river-bank.

PLUMAS COUNTY.

L. N. Tefft has several men employed in fitting up the Illinois placer claim near Cromberg; he also has the Lone Star and Concordia mines ready to run. The latter contains a body of gravel nearly 200 ft. deep; this is said to prospect fairly well from surface to bedrock.

SHASTA COUNTY.

The roadbed of the Sacramento Valley & Eastern railroad has been graded to Delamar and the rails will soon be laid. Freight for the Bully Hill mine and smelter is being hauled by wagon from Horse Creek station, only two miles from Delamar. March 1 has been fixed as the probable date for blowing in the remodeled and enlarged smelter at Delamar.——Since smelter construction ceased at Coram business has become so slack that the Southern Pacific Co. has closed its station at that point.——Fred Maxwell reports that he has found a good body of ore in the old workings of the Uncle Sam mine, near where the last lessees, Nicholas & Thomas, took out their ore.

SIERRA COUNTY.

A test run of 5100 lb. of ore from the Wyoming mine at Alleghany which was recently crushed in the Eldorado mill yielded by amalgamation $580.80; this is equivalent to $227.76 gold per ton of ore. In addition about 50 lb. of sulphides were saved on the concentrating table. A winze which is being sunk on the lode is 15 ft. deep; in the bottom the ore is 4 to 5 ft. wide. Stanley M. Welland is superintendent.——The Happy Jack lode is being developed under bond and lease by Frank McLaughlin; he is driving an adit on it.

SISKIYOU COUNTY.

The Adeline Ricks mill near Callahan is crushing about 50 tons of ore per day; Frank Zeigler is superintendent. ——The open winter season has been of great help to mining men in enabling them to haul in supplies to continue development work. Many mining companies that have formerly ceased operating during the severe months, this year have continued with unabated vigor.

TEHAMA COUNTY.

It is said that William Shader's big steam drilling plant has sunk one hole 118 ft. and another over 60 ft. on the ranch of J. W. Widner, the object being to test the claim of O. H. Stott that he has found by means of an apparatus (which he calls a plumb bob) that will be attracted by gold, a place under which there is gold. The drillers seem to have been more successful in finding water than gold.

TRINITY COUNTY.

Including lessees, about 25 men are mining ore at the Brown Bear properties. The mill will be started as soon

as the roads are in condition suitable for ore hauling.—— At the Lappin mine a small force of men is doing development work. In the spring the force is to be increased and the mill started. The owners intend to install an electrical equipment, connecting with the Northern California Power Co.'s line at the Brunswick mine.——C. A. Carter, the owner of the Hostetter gravel mine at Minersville, has two monitors set and everything in readiness for work; he is waiting for the water months, which in that section are usually March, April, and May.

TUOLUMNE COUNTY.

A cross-cut is being driven for the main adit of the Wallwood mine to cut the lode at greater depth than heretofore exposed.——The main adit of the Morgan mine at Carson Hill is being cleared of debris to admit a party of English experts to the underground workings to make an examination of the lode; the samples taken will be sent to England.——S. A. Ryland of the Angels Iron Works is in charge of the construction of the new Kanaka mill at Groveland.——The new tramway at the Cosmopolite mine has been completed; it is expected that now the mill can be kept in continuous operation.——Frank Webber, a junk dealer and trader of Stockton, has been arrested on the charge of having stolen two plates from the Bonanza quartz

mill in North Sonora. These plates, with the amalgam on them, were worth at least $500.

YUBA COUNTY.

The Weed's Point mine near Camptonville is being successfully operated; the long bedrock adit was completed some time ago. The gravel is said to be profitable to mine. Two good restraining barriers impound the debris. C. L. Crane is manager.

COLORADO.

CLEAR CREEK COUNTY.

(Special Correspondence).—The new 50-ton mill of the Empire Tunnel Co. was put into commission the middle of last week. The machinery consists of two gyratory Hatheway mills and occupies very little space on the floor; from the test runs of the same a saving of 94% of the gold was effected. The process includes fine-grinding, reducing to 200 mesh. In this manner the gold is released from its coating; by a spray of water shooting up from below, the gold and rock are lifted, the gold dropping first, where it is gathered up by quicksilver. It is then transferred to the bullion box, which at all times is kept securely locked; in time it is retorted and disposed of at the U. S. mint. If the mill will do one-half the work that is claimed for it, a new era will dawn for the sulphide belt of upper Clear Creek. It will result in scores upon scores of low-grade mines being placed upon a paying basis, as throughout the Empire section enormous bodies of ore are showing which could not formerly be handled at a profit. The people of this district are anxiously awaiting the final results, as no time will be lost in placing orders for mills. The Empire mill is being fed upon ore found in the Gold Dirt mine, and from the test runs it has been ascertained that the material can be mined and milled at a cost of not over 75c. per ton.——The Capital mill is now running steadily and it is reported that a high saving is being effected. The machinery is being run on ore taken from the east and west drifts on the Aetna vein. Over 1000 tons of this material are in reserve, while the mill-bins are filled to the top. Manager W. M. Cooper is adding to the working force and will have between 100 and 150 men at work inside of 30 days.——Shipments from the Columbia mine on Silver mountain were started this week by the lessee, John Graham. Stoping is in progress upon a streak of gold-bearing ore that is from 18 in. to 2 ft. wide, the average value of which is $39 per ton.——L. Baccheirl has taken a lease upon the Wide West mine on Leavenworth mountain. A force of 10 men has been put to work in cleaning out the workings, and shipments of both high and medium-grade ore will be inaugurated inside of the next 30 days. This mine has a record of having surrendered in excess of $1,000,000, and the ground has not been worked to a depth exceeding 600 ft. It is surrounded by such famous producers as the Colorado Central, Allunde, Kirtley, and Equator, the combined output of which is in the neighborhood of $20,000,000.——The Miller adit on Saxon mountain is being driven steadily forward, having now been advanced for 450 ft. According to surveys a vein will be reached within from 40 to 50 ft.——Operations were put under way this week upon the Panama group of five claims, situated on Columbia mountain. The adit, in 125 ft., is being advanced to intersect a vein that lies 20 ft. distant. Considerable scattered ore running through an 8-in. streak of quartz is showing in the heading. E. E. Grubb & Co., are operating under lease.——H. W. Kirby & Co., who own the Bernhardt group of claims on Green Lake mountain, are employing a force of men in driving the adit for the intersection of the veins. One lode was recently cut, and while a big body of mineralized quartz is showing, no drifting has been performed.——J. F. Allinde, leasing at the Santiago mine, has uncovered a 2-ft. streak of ore that shows by assay 14% copper and 3 oz. gold per ton. A total of 40 tons was run over the aerial tramway last week. ——Wood & Co., leasing on the 14th level of the Terrible mine, have 60 tons of smelting ore ready for shipment; this will mill on an average $50 per ton in silver and lead. In addition to this, over 200 tons of concentrating ore have been placed in the mill-bins; it will receive treatment as soon as there is sufficient water flowing through the pipeline to permit of operating the machinery. Large development on company time is promised for the near future. ——The New Boston mine on Democrat mountain has been bonded and leased to McKarahan & Parks, the bond calling for $35,000. These operators have secured the use of the aerial tramway owned by the Democrat Mt. M. Co., as well as the privilege of treating the ore at that company's mill, which has a capacity of 50 tons daily. The concentrating material is a lead-zinc ore, while the smelting ore brings returns of 40 oz. silver per ton and 60% in lead.——The Dunkirk mine, a famous old producer of Sherman mountain, is again undergoing development in an energetic manner. This property recently passed over to a syndicate of Denver capitalists, headed by M. D. Smith of Georgetown. The raise from the Ashby adit is being placed in condition and levels are to be run from each 100-ft. station. Large streaks of good-grade ore are showing in many of the workings, and shipments are promised for the near future.——Active development is under way at the Collins property on Leavenworth mountain. The adit is being driven to intersect the vein at a depth of 150 ft. under the shaft workings. In the bottom of the shaft a streak of ore is showing which is 8 in. thick, the average value of which is $50 per ton in silver and lead.—— Work has been resumed in the driving of the Bi-Metallic adit, which is now in 1000 ft. The first vein to be reached is the Blue Bell; this produced much high-grade ore a number of years ago. John W. Boughton of Silver Plume is general manager.

Georgetown, Feb. 1.

MISSOURI.

JASPER COUNTY.

(Special Correspondence).—The resumption of the Cherokee Lanyon smelters at Gas City and Coffeyville, one-half of the Ozark Oxide Co.'s plant at Coffeyville, together with two additional blocks of furnaces at the Lanyon-Starr smelters at Bartlesville, added strength to the demand for zinc ores during the first week of February. However, the increase in production fully met the demand and there was no advance in price. For the week ending Feb. 1 the shipment of zinc ore fell 800 tons below that of the previous week, owing to the operators holding for higher prices. Lead shipments were 188 tons greater and brought from $48 to $50.50 per ton for the 80% grades.——The rejuvenation and extension of the Carl Junction camp the past few months have been among the important developments in the Missouri-Kansas field. When the old Lehigh mines were active some years ago prospecting was prevalent all over the camp, but no free orebodies of importance were discovered, although a number of strikes of low-grade sheet-ground were made. Interest in that camp flagged until the development and successful exploitation of sheet-ground in the Webb City camp proved to operators the value of such deposits. Since then operations have been resumed in Carl Junction, and an important addition to the mining district is now being developed. The Kramer Mining Co. has undertaken the development of 400 acres of land surrounding the camp. A large part of this has been drilled and a peculiar sheet-ore formation discovered on lands lying north and west of the town. This ore is a finely disseminated blende in a matrix of silicious mud-rock. The rock is apparently a sediment resulting from the degradation of the carbonaceous shales of the Pennsylvanan rocks, highly silicified. The intimate mixture of the blende with it presents a problem in milling which necessitates extremely fine crushing and table concentration to recover the blende. The extent of the orebody has been shown by drilling to be very large, underlying over 200 acres of land, and the drilling is not yet completed. On the lease north of the city shafts were put down, but water proved a hard problem below the 180-ft. level. A pumping plant with a capacity of 5000 gal. per min. was installed before the orebody could be reached and opened up. The heaviest deposits of ore occurred at 225 ft. After

thoroughly developing the deposit and testing the ores, a concentrating plant was designed to treat them. While modeled after the regular type of Joplin mill, it is designed to slime all the chats, the proportion of cleaned concentrate being greater from the table concentrators than from the jigs. The capacity of the mill is 400 tons per 10-hr. shift. The mill began operations this week and there are 10,000 tons of ore on the dump awaiting treatment. The experiment of treating this peculiar sheet-ore is being watched with interest, and if successful will inaugurate the development of large tracts of adjoining lands. West of the city this same company has sunk a shaft and the orebody has just been penetrated. The deposit is sheet-ore but free from the features found in the deposit on the north lease. A concentrating plant will be erected at this shaft during the early spring. W. C. Kramer is manager of the company's field operations.——The developments to the south have been as important as those noted north and west. The land of the Avondale Mining Co. has been actively prospected and the operations have resulted in a wide area of proved ground. On the west 80 acres, the Jubilee Mining Co. has a sub-lease and has put down 25 drill-holes. A number of workable orebodies have been demonstrated. This company is now sinking a shaft on the east side of the tract and a sub-lease was given to the Lehigh Zinc Mining Co. on 12 lots, on the west side. Upon this sub-lease a body of sheet-ore has been opened and a 150-ton mill will be erected. Two other sub-leases have been developed sufficiently to reach the ore, but the extent of the deposits has not been determined.——The sub-lease held by the Carl Junction Mining Co. has reached a producing stage. On a six-lot lease an orebody 150 ft. long, 145 ft. wide, and from 15 to 20 ft. thick has been developed at the 100-ft. level. The full extent of the orebody is not yet known as the headings are still in ore. A 125-ton concentrating plant has been erected and began operations last week. The ore is exceptionally free and runs at times as high as 30% zinc. The discoveries of new bodies of sheet-ore and the development of these free-ore deposits have started a new movement of prospecting throughout the Carl Junction camp. The importance of this development is noted in the large increase in the production of this camp in 1907 over that in 1906.——The drilling recently undertaken by L. P. Benua of Carthage on the old Porter mining tract in the northwest portion of that city has resulted in the discovery of a rich deposit of blende. The ore was first encountered at 35 ft. and continued in open ground to 111 ft., where the drill entered a deposit of chert and blende extending to 167 ft. This tract was once famous as a producer from the shallow levels but had been abandoned for years, no attention having been given to the lower levels. The recent discovery has given a new lease of productivity to a tract of at least 60 acres.

Joplin, Feb. 5.

NEVADA.

CHURCHILL COUNTY.

Formal transfer of stock representing the control of the Fairview Eagle's Nest Mining Co. was made on Feb. 5 to O. P. Posey. This property was one of the assets of the Sullivan Trust Co. which failed with liabilities amounting to $1,200,000.——An old-time stampede out of Fairview, Fallon, and Rawhide occurred on the night of Feb. 5, when the people of these towns got word that a strike of exceedingly rich gold ore had been made by Archie Graham in the range back of Sand Springs; samples taken at the property assayed from $1700 to $2100 per ton, principally gold.

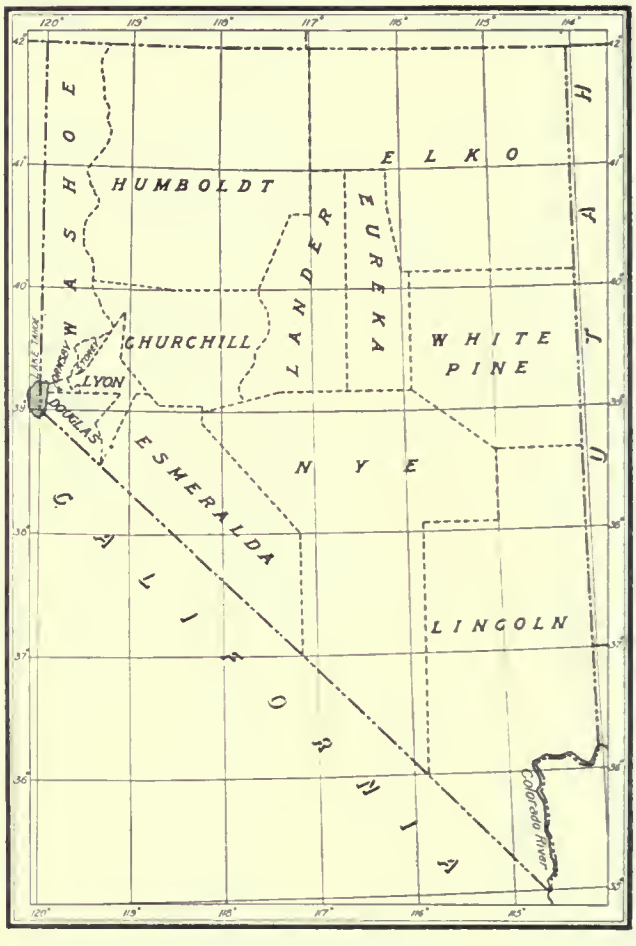
ELKO COUNTY.

Blewett Bros. are working two shifts at the Jack Pot mine at Aura; they have cut the lode in the lower adit. ——The owners of the Big Four mine are steadily driving No. 2 adit; a sample from the ore sacked has assayed $162.31 gold and silver per ton. The vein averages 3 ft. 10 in. wide.——Theo. Storff is operating his placer mine in the valley of Sheridan creek; this valley has some of the best placer ground in the Aura district.——The business men of Battle Mountain are planning to construct a railroad to Gold Circle.

ESMERALDA COUNTY.

President Roosevelt has telegraphed to Governor Sparks that the troops will be withdrawn from Goldfield on March 7. It is expected that by that date the organization and equipment of the State police will have been completed. The Governor has appointed Captain W. L. Cox superintendent and A. W. Cahlan inspector of police. As soon as equipments have arrived from the Eastern States 30 members of the newly appointed police will be sent to Goldfield, where they will be drilled. It is said that the cost of living in Goldfield has been greatly reduced; the miner who receives $4 per day now can purchase much more for this sum than he could for $5 a few months ago. This condition strongly supports the position of the Goldfield Mine Operators' Association in its change in the scale of wages for work performed in and about the mines.

Although at least 2000 miners were out of work on account of the strike, and many heavy producing properties were closed down, the January production of the Goldfield district was valued at $427,807.50; the Combination mill crushed daily 85 tons of ore, of an average value of $62.50 per ton, or a total of $164,687.50; a small run of ore from Goldfield Consolidated properties that was treated at the Kinkead yielded $5000; the Western Ore Purchasing Co. received 358 tons, of a total value of $32,220; 400 tons of ore from the Combination Fraction, Mohawk-Jumbo, Sandstorm, and Great Western mines, treated at the Nevada-Goldfield Reduction Works, yielded $38,000; and 947 tons shipped to the smelters produced $187,900.——While practically no production is being made by the properties of the Goldfield Consolidated company, with the exception of sufficient ore to keep the Combination mill running, they are being actively developed. The mines are being manned by non-union miners and by members of the new organization, the Nevada Miners' Union No. 1. It is said that all the help needed by the company is obtainable and that three shifts are employed.——The superintendent of the Nevada-California Power Co. has been looking over the



The Counties of Nevada.

ground with a view to extending a branch line into the Stimler district.——The main shaft of the Murray lease at Rawhide when 43 ft. deep is said to have exposed rich ore. Grab sampling from the ore that was being hoisted at that time indicated that it carried about $100 per ton.

LANDER COUNTY.

(Special Correspondence).—The Western Mines Development Co., of which J. D. Hubbard is president, has acquired the Hidden Treasure group in Mill canyon, 30 miles south of Beowaive station, and has consolidated it with an adjoining property which had been acquired by V. P. Strange of Salt Lake. Gold ore of milling grade has been uncovered and a force of 10 men is at work, under the direction of Mr. Strange.——Major Gillette of Philadelphia has taken over the Little Gem group of claims owned by the Reliance Mining Co., near Tenabo. This is to be consolidated with adjoining property and further development is to be prosecuted on the exposed orebody. The intention is to erect a mill.

Beowaive, Feb. 7.

LYON COUNTY.

It is reported that about Feb. 9, A. H. Gale and J. R. Thompson, former railroad laborers, after being lost for 24 hr. in a storm in the Wild Horse mining district, 12 miles south of Hazen, found a 3-in. vein of high-grade gold ore. This was reported throughout the country near Hazen and many of the residents of that town and 200 of the men employed on the Government reclamation project have deserted their work to rush to the scene of the strike.

NYE COUNTY.

(Special Correspondence).—The development of properties in the camp is proceeding in a fairly active manner, considering the condition of the money market and the strain upon all interests in this section of Nevada for the last three or four months. Frank Peterson and associates, of New York, have bought out all interests in the Manhattan Ore Reduction & Refining Co., which includes the holdings of E. B. Cushman and J. H. G. Wolf, as well as the mining companies interested in the enterprise, for which Peterson and associates have paid something over $75,000, and on which they will spend an additional $10,000 to increase the power, so as to treat 40 tons of ore per day. The plant is a 10-stamp battery, with classifiers, tube-mill, Butters filter plant, 40 frames, and zinc precipitation press, of the Merrill type, using zinc dust as precipitant. Mr. Peterson and his associates have also taken a five-year lease on three of the promising properties on Gold Hill, namely, the Stray Dog, Jumping Jack, and the Indian Camp, and expect to develop these properties sufficiently in the next six months to produce ore regularly for the mill. Meanwhile the milling plant will run on a contract made with the Manhattan Consolidated Co. for the reduction of its ore.

Manhattan, Feb. 7.

The ore shipments over the Tonopah & Goldfield railroad for the week ending Feb. 6, as reported by the Western Ore Purchasing Co., consisted of 88 tons from the Tonopah Extension and 80 tons from the MacNamara mine. The Tonopah company sent 3100, the Belmont company 940, the Jim Butler 167, and the Montana-Tonopah 1100 tons to the mills. The total output of the Tonopah mines was 5475 tons, of an estimated value (the shipping ore being valued at $60 per ton and the milling ore at $20 per ton) of $116,220.——At the Belmont mine two more veins to the south of the South vein have been cut on the 8th level; the first vein is 8 in. wide and carries $125 per ton, the second vein is 12 in. wide, but the ore has not yet been assayed. A. H. Jones has been appointed superintendent of the mill.——Two carloads of ore aggregating 100 tons, of an estimated value of $125 per ton, were recently shipped from the MacNamara mine.——At the Tonopah Extension mine, driving on the 1050-ft. level, below the dacite, is said to have cut many large stringers that indicate proximity to a large orebody.——About 135 men are employed by the Montana-Tonopah Co.——The material for the cyanide plant at the Bullfrog Pioneer mine has been delayed by stormy weather. A Balke crusher has been purchased. The ore in the drifts on the 110-ft. level assays $10 per ton.——The pipe supply at the Gold Bar stamp-mill was not strong enough to stand the pressure and burst at the first test.——The new owners of the Montgomery-Shoshone Extension property are preparing to install a compressor and sink the shaft from the 300 to the 500-ft. level.——On the Denver vein of the Tramp Consolidated property good ore has been found; Charles N. Carding has succeeded W. D. Blackmer as manager.——The Montgomery-Shoshone company continues to ship a carload of high-grade ore per day to the smelter.——The main shaft of the Crœsus mine is 360 ft. deep; sinking will be continued.——On the 400-ft. level of the Mayflower Consolidated mine, a vein 22 ft. wide has been cut; it consists of good-grade free-milling ore.

STOREY COUNTY.

More men are now employed in the mines at Virginia City than for several years. The recent uncovering of a new body of rich ore in the Ophir mine has given further encouragement to other companies that have been doing development work; 120 men are employed by the Ophir company.——In the Yellow Jacket mine 40 more miners were placed at work on Feb. 5.——The New York-Nevada company is at present operating the Underground mine.

WHITE PINE COUNTY.

The Black Horse Central Mining Co. intends to erect a custom mill at Black Horse; it is to have 20 stamps, four Frue vanners, four Wilfley tables, and a cyanide plant. A. G. Burritt is president of the company.——It is expected that as soon as the snow melts there will be a wild rush into the Steptoe district; the Vulcan mine of the district already producing shipping ore.——At the Siegel mine 15 men have been doing development work during the winter and the property now has in reserve and on the dumps several hundred tons of high-grade silver-manganese-iron ore; for years every smelting company near Salt Lake to which this ore has been shipped, has paid the Siegel company a premium above its assay value.

UTAH.

JUAB COUNTY.

(Special Correspondence).—The Tintic Smelting Co., controlled by Jesse Knight of Provo and managed by W. L. Mangum, is making good progress on the construction of its smelting plant, situated between Eureka and Silver City. By next May it is estimated that the plant will be ready for business. It will start with two 46 by 162-in. lead furnaces and two hand roasters for roasting the sulphide ores; each is 14 ft. by 60 ft. 1 in. The plant will also be provided with a 300-ton sampling mill, a briquetting machine and a bullion melting room for dressing the bullion. It is being constructed under direction of Howard P. Saunders as consulting mechanical engineer. It is stated that Richard F. McCaffrey of Salt Lake is to be superintendent and metallurgist when the plant begins operating. The mines being operated by Mr. Knight and associates include the Colorado, Black Jack, May Day, Beck Tunnel, Iron Blossom, and others.

Tintic, Feb. 7.

CANADA.

BRITISH COLUMBIA.

The ore shipments from the British Columbia districts for the week ending Feb. 1 were as follows: Boundary, 22,011 tons; Rossland, 5915; East of Columbia River, 3052; total, 31,008 tons. The receipts at the smelters were as follows: Grand Forks, 22,011 tons; Trail, 6011; Northport, 1240; Marysville, 675; total, 29,937 tons.——Despite the somewhat discouraging price of lead, shipping has been going on freely from the Slocan district.——Arrangements have been made for the immediate installation of extensive mining machinery at the Little Bertha mine at Bannock City.——Contractors are engaged in sinking a shaft at the Handy Group mine, which is situated at the junction of Lynch creek and the Lardo river.——Louis Pratt and J. A. Whittier have taken a lease and bond on the Province group of claims.——Good ore has been found in a 52-ft. adit on the Peacock group of claims in the Nicola district.

Special Correspondence.

LONDON.

Gold Mining in Tasmania.—The Diamond Market.—Champ D'Or.—Coal in Natal.—Deep Mining at Kalgoorlie.—Mr. Landau's Lament.

The Tasmania Gold Mining Co. is still unable to record a profit. The company was formed in 1903 by John Taylor & Sons to acquire a number of properties in the Beaconsfield district of Tasmania. These properties had been worked by various owners for many years, and with good results, but unfortunately operations had to be suspended owing to the workings arriving at the water-level, below which it was impossible for anybody but a millionaire to sink. The workings appeared to form a channel for the drainage of the surrounding country. When John Taylor & Sons took up the business the first thing to be done was to provide pumping engines of great capacity, made by Hathorn Davey & Co. of Leeds. During the erection of this machinery, the elements gave further evidence of what they can do in the way of flooding, and a great deal of damage was done to the mine and to the plant. However, during most of this time the production of gold went on, and during the three years ended September 30 last the output has been steady at about £130,000 per annum. The current expenditure on ordinary operations, and the special expenditure on flood protection have more than wiped out any profit so far. The works are now in good condition, and it is not likely that operations will be interrupted in the future. The geology of the neighborhood has received expert study, with a view to ascertaining the sources and courses of the underground waters, and the information obtained is valuable.

During the twelve months ended on September 30, 58,339 long tons were milled, yielding 23,434 oz. fine gold. A further 7078 oz. were obtained by chlorination and cyanidation, making a total output of 30,512 oz. The gold contents vary in depth. At the point where most of the work is being done, the ore was richest at the 900 and 1000-ft. levels. At the 1100-ft. level the grade has fallen off, but judging from the records of variation in the upper levels, the engineers are hopeful of finding better ore again, as they continue sinking. There is plenty of ore ready for the mills, and now that extra expenditure has come to an end, there is every prospect of a divisible profit being made during the current year.

Trouble among diamond producers continues. The latest news is that the Lace Diamond mine suspended operations owing to the impossibility of selling the output. This mine is situated 16 miles northwest from Kroonstad, in the Orange River Colony, and was opened up by J. Dale Lace. Active operations commenced in 1902, but during 1905 an interruption was caused by shortness of water-supply. Since April, 1906, the work has been continuous until last week. On December 31, 1906, the amount of blue ground on the floors was nearly 1,000,000 loads. The average contents are from 10 to 13 carats per 100 loads, as compared with 25 to 40 carats per 100 loads at the various mines belonging to De Beers. The company owning the mine has never made any profit, so under present circumstances, a shut-down is doubly wise. Another indication of the condition of the diamond trade is the decision of the Premier Diamond Mining Co. to cancel the announcement made in December with regard to dividends. It was then stated that the results of working for the year ended October 30 warranted the distribution of a dividend on the ordinary shares amounting to £400,000. Of this amount the Transvaal government would be entitled to £240,000, while £160,000 would go to the shareholders. When the De Beers company announced shortly afterward that it would pay nothing at present on the ordinary shares, the Premier company desired to rescind its dividend notice. The difficulty, however, was to induce the Transvaal government to forego its rights. An agreement between the Government and the company has now been made, so that the company is enabled to keep all its funds intact.

The engineer of the Champ O'Or in the western portion of the Rand has issued a further estimate of the life of this mine. He considers that it will last until the coming May. If subsidences take place the mine will close down before then. On the other hand, if no sign of subsidence appears, it will be possible to extract the ore left in the pillars in the upper part of the mine. In addition to ore in the mine, there are accumulations of slime still to be treated. These will last, at the present rate of treatment, until the end of the current year. The mine is owned in France and has been worked since 1891. There are 60 stamps, and the output has varied from 20,000 to 50,000 oz. gold per annum. The company has not on the whole been a very successful one financially. The approaching exhaustion of this mine follows closely on that of the Bonanza. The two mines were unlike, for the latter contained the highest grade ore on the Rand and made large profits. Both, however, were small mines, a fact which accounts for their comparatively early exhaustion.

Map of South Africa.

At the present time it is not easy to raise capital for new ventures. It is of interest to note therefore that the Commonwealth Oil Co., owning shale oil deposits in Australia, has been successful in placing a large issue of debentures. This company is under the control of two of our large publishers of popular literature, Newnes and Harmsworth. Another new issue making its appeal to the public is the Vryheid Natal Railway Coal & Iron Co., which has been formed by G. H. Bonas for the purpose of acquiring and equipping the Hlobane colliery near Vryheid, in Natal. This company is asking for £175,000, to be used for outfit and for the completion of a branch railway. The coal deposits are extensive and the company hopes to obtain a share of the export trade at Durban. The property also contains iron and manganese deposits, of which I hope to give particulars at a later date.

Mr. Hermann Landau created some stir in the West Australian market this week by stating publicly that in his opinion the Western Australian government should spend £100,000 or £200,000 on a thor-

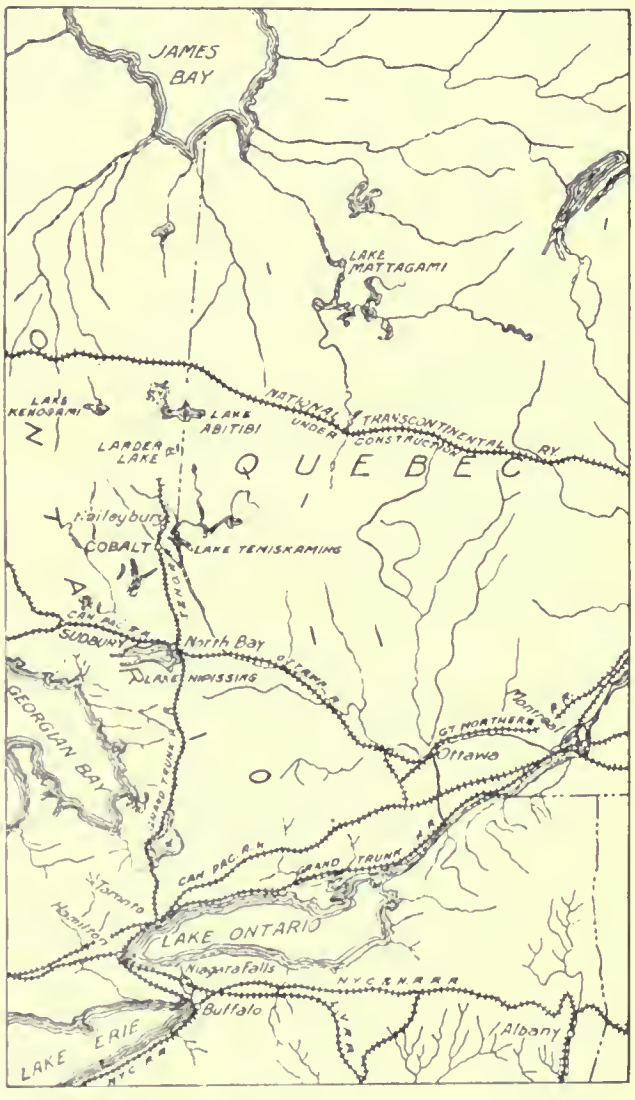
ough geologieal examination of the Kalgoorlie distriet. He was in a pessimistie mood, prophesying that many of the mines would have to be abandoned when the deposits beeame poor in depth. He did not reeeive much support, as it is generally felt that prospeeting at depth is not a government's duty. His remarks were made at the meeting of the Asso-eiated Northern Blocks; he took oeeasion to warn shareholders that the lower levels of the mine did not hold out mueh promise. He mentioned that the ore reserves on September 30 were 149,181 tons estimated to eontain 91,804 oz. gold, which amonts to 3½ years' supply. This is a fair enough prospeet for a mining company, and it is too early in the day to talk about falling back on public money for the purpose of prospeeting. A year ago the reserves were 101,769 tons, averaging 19.8 dwt. per ton, eompared now with 149,181 tons containing 12.3 dwt. It is this deerease in the average eontents that depresses Mr. Landau. Sinee the mine started work in 1899, the total ore treated to date has been 182,683 short tons, and the value of the gold extraeted has been £1,277,941, of which £577,500 was distributed as dividends, being at the rate of 165% on the capital. In addition, the eompany has eash on hand and a reserve fund invested in first-elass seeurities amounting to no less than £166,800. Practieally the whole of the expenditure on development and equipment has been paid out of profit and the mill and plant stand in the balance sheet at the nominal sum of £10,000. When you eome to think of it, is not Mr. Landau or his company in a better position to provide funds for prospecting than the government? Perhaps the directors and shareholders, having reaped a substantial profit, might like to win a reputation for public spirit?

TORONTO, CANADA.

Summary Reports of the Geological Survey.—Discoveries of Coal.—Shipments From Cobalt.—Other News.—Asbestos.

The summary report of the Geologieal Survey of Canada for 1907, just issued, giving the results of the investigations made by twenty parties in nearly every provinee of Canada, eontains mueh praetieal information as regards mineral diseoveries of eeonomie value, especially in the Canadian West. As the result of the work of D. D. Cairnes in the Yukon Territory, enormous quantities of available bituminous coal have been found. The coal measures that eross the Lewes river at Tantalus have been found to extend in a northerly direetion for several miles at least and in a southerly direetion for over 50 miles, crossing the Whitehorse-Dawson wagon road 70 miles from Whitehorse and in all probability extending considerably farther. Wherever a seetion has been made, two or more workable seams of good bituminous eoal have been found. In the places where it has been obtained at a depth, the eoal cokes satisfactorily. W. W. Leach, who eontinued work in the Bulkley valley, B. C., reports the diseovery of a new eoal area on the Goldstream about 2 by 2½ miles in extent, showing two seams of 5½ and 3½ ft. respeetively of elean bright coal. Another smaller area was found in the same loeality. Mr. Leach considers it fairly certain that no great coalfield exists in the Bulkley Valley district from Hazelton to the headwaters of the Moriee, though small isolated areas are known. It is not probable that much development will be undertaken on the coal properties situated on the Telkwa river and Goat ereek, until the route of the Grand Trunk Pacific is finally selected. D. B. Dowling's examination of the coal areas on the south branch of the Brazeau river behind the Bighorn range in the Rocky Mountain region, where a big coal-seam was found in 1906, has resulted in the finding of other seams. The workable seams have a total thiekness of 66 ft. 4 in. The area from Lake Temiskaming westward in Quebec Province has been a good deal prospected in the expeetation that the Cobalt formation might be found to extend in that direetion. Morley E. Wilson, in reporting his investigations in this region, states that no discoveries of eeonomie importanee have been made. Sinee the silver ores of Ontario are associated with the post-Huronian diabase, the limited extent of this roek in the area examined greatly reduces the probability of similar diseoveries.

The Survey has undertaken a systematie investigation of the coals of the Dominion by an exhaustive



Map Showing Position of Cobalt and New Districts in Ontario.

series of eeonomie and chemieal tests, which include eoal washing and (when necessary) dry eleaning, followed by boiler tests. Other portions are to be treated in gas-producers provided with devices for measuring the power developed, and competitive eoking tests will also be carried out. The co-operation of the mining and mechanical engineering departments of McGill University, of Montreal, has been seeured. The investigation is under the general direetion of J. B. Porter, R. J. Durley having charge of the boiler tests and producer gas experiments. It is proposed to secure sample lots of 10 tons of average coal from each mine. About 175 tons have been already procured from the mines of Nova Scotia and New Brunswick and subjected to the boiler tests and it is hoped to cover the Western coalfields this season.

Ore shipments from Cobalt for the week ending

January 25 amounted to 492 tons from the following mines: Coniagas, 33 tons; Foster, 20; La Rose, 150; McKinley-Darragh, 60; Nipissing, 32; Standard, 19; Silver Queen, 121; Silver Cliff, 26; Temiskaming, 29 tons. At the annual meeting of the Erie Cobalt Mining Co. on the 27th ult., reports were presented showing $49,000 expended on development. The company has on hand low-grade ore, the value of which is estimated at between $50,000 and $60,000. It was determined to install additional modern mining machinery. The shareholders of the Peterson Lake mine last week refused to ratify a deal made by the directors for the sale of 30 acres of their property to the Nova Scotia for 150,000 paid-up shares in the latter company. A good strike has been made on the Cobalt Lake property in an adit under the lake at the 86-ft. level. The vein is 2 ft. 6 in. wide, carrying native silver. The company has on hand four cars of high-grade ore. The Cleveland Cobalt recently struck a vein 7 ft. wide at the 125-ft. level, showing low silver contents. O'Neil Gordon, general manager, has resigned his position.——John Harris, superintendent of the McKinley-Darragh mine, has resigned.

A rich deposit of asbestos has been found about four miles from the village of Melbourne, Quebec. The vein is thought to be a continuation of one that has been successfully worked near Danville. Some Sherbrooke capitalists have become interested in the property.

DENVER, COLORADO.

Activity at Leadville.—Forest Supervision.—Activity in the San Juan.—Portland Meeting.—Routt County Coal-Fields.

Mining at Leadville is slowly picking up as the smelters are able to take more of the ore. The activity in prospecting for gold has resulted in the opening of the Margaret mine, 26 miles west of Leadville. This is a new property and is claimed by men familiar with the district to be on the extension of the old Yankee Blade vein. The famous London mine situated over the range in Park county is producing steadily. The open weather has particularly favored shipping. Twenty teams are now engaged in hauling the ore to Leadville. The leasing system is gaining favor in this camp. More than the usual number of leases have been granted thus far. Several of the mines are now working three shifts, but as yet most of the work is confined to prospecting and development of properties producing gold ore.

Confidence is returning to the mine operators in the San Juan region. The Snow Flake property at Red mountain and the Des Ouray property at Ouray have both resumed operations during the past week. Another shift has been added to the working force on the First National property. The recent strike reported at the Camp Bird has encouraged everybody and largely accounts for the general resumption of operations. The Emma Gold Mining Co. of Rico is at work installing additional machinery preparatory to sinking a shaft at the mouth of their main drainage adit. This company is also increasing its milling capacity by the addition of 15 stamps. The Pennsylvania tunnel at Telluride has been connected by a raise of 416 ft. with the Smuggler-Union workings. This adit was started about ten years ago; it opens an immense area of stoping ground, for the Smuggler vein is so persistent that it has been stoped for a mile continuously.

The Newhouse tunnel has proved such a success at Idaho Springs that preparations are now being made to continue the Lucania tunnel from Idaho Springs into Bellevue Mtn., where there are several valuable properties that can best be operated through such an adit. The tunnel is already 4209 ft. long, and several veins, yielding fair returns, have been cut. The old Burell mine on Alps Mtn. is being re-opened by G. E. Wroekloff under a lease. This mine has been idle for over twenty years. The shaft is being re-timbered and new machinery installed. Within the month the Burleigh tunnel will be connected by the Phillips raise to the bottom of the shaft of the Seven Thirty property. This will make leasing easier and more profitable at Silver Plume.

The Cripple Creek district has started off well for the first month in 1908. The production amounted to 56,785 tons, valued at $1,335,820. This increase in production is due in great measure to the recent cut in freight and treatment charges made by the United States Reduction & Refining Co. The competition between this company and the Golden Cycle is very keen, and the Cripple Creek operators are the gainers. Several old properties have been opened during the month and leases are in demand on almost every available property. Likewise several new and important finds have been made in the productive mines. All these factors, combined with the usual managerial hustle to make a good showing just before the annual stockholders meetings, resulted in an exceptionally good month.

The annual meeting of the forest supervisors of Colorado and surrounding States was held at Leadville during the first week in February. A great deal of interesting information was given out and some rather astonishing facts. The policy of the Forestry Department in keeping the forest reserves better and more efficiently supervised has been severely criticised, and the Government has been accused of meddling with the affairs of private individuals. The need of activity on the part of the Forestry Department is plainly evident when it is learned that fully 75% of the homestead locations in the Las Animas reserve alone are fraudulent. When the forest service first took control of that reserve fully $500 worth of timber was being cut illegally every day. The work of the Department is being enlarged, and hereafter it will employ expert miners and geologists to inspect all mineral claims that are to be located on reserves. As far as possible the Department intends to exclude mineral areas from future reserves.

The San Juan district continues active despite the slow recovery in the financial world and adverse climatic conditions at this time of year. Development work on the property of the Mountain Flower Mining Co. has been suspended until spring. This property is on the east fork of Deep creek, in a very precipitous region, and the prevalence of snow-slides makes it advisable to cease operations at present. At the Chipeta tunnel, near Ouray, repair work and cleaning out are being done by a small gang of men. The Silver Chief group is now shipping ore regularly from Telluride and more than the usual amount of development work is being done in the Bridal Veil basin, about four miles southeast of that town.

The Russell-Page Mining & Tunnel Co., which owns a group of five claims at the head of Cascade creek and has a lease on the Cynosure claim near Idaho Springs, is installing a boiler and air-compressor preparatory to continuing an adit to drain these properties. Considerable dissatisfaction is expressed by the operators and lessees with the ore-buyers at Georgetown. A local newspaper published a correspondent's letter in which the ore-buying companies are charged with fraud and collusion with the assayers. Whatever may be the real grounds for dissatisfaction, it must be remembered that grab sampling is not as accurate as the method employed at the samplers. Assays on samples taken

at random cannot be expected to check with a systematic sampling and assay.

It is now assured that the Moffat railroad is to be the only one leading into the Routt county coalfields. The Union Pacific recently completed its surveys from Wamsutter, in Wyoming, to Craig, in Routt county, and announced that the line would be built at once. It is to be regretted that this coalfield is not to have the advantage of competing railroad lines. Financial stringency and uncertainty regarding the outcome of the next presidential election are the reasons given for abandoning the project.

T. R. Countryman of Cripple Creek gave a lecture before the Colorado Polytechnic Society on February 8. The subject of the paper was 'Drainage in the Cripple Creek District.' After describing the geology of the great gold camp as a phonolite sponge cut by many basic dikes and held in an impervious granite cup, Mr. Countryman reviewed the history of the various drainage schemes and how they proved a common water-level. The adit that is now being driven will lower the present water-level 700 ft. and will require at least 36 months to complete. It will be of interest to compare the contractors' estimate of 24 months with the engineers' estimate when the tunnel is completed.——The annual meeting of the Portland Gold Mining Co. was held at Cheyenne, Wyoming, on February 3. The old officers were re-elected for the ensuing year. Recent developments in the lower workings of the mine have disclosed large high-grade orebodies. The same is true of many other mines in the district. It is now believed that the U. S. Geological Survey report on the district was too conservative. It is true that the orebodies seem to converge in depth. On the other hand, the ore is richer and as yet the veins are strong and well defined in depth. The experience of the Isabella mine, which has found high-grade ore-shoots in depth and been enabled to pay off all its indebtedness, is very encouraging to those whose ore reserves will be exhausted before the drainage adit is completed.

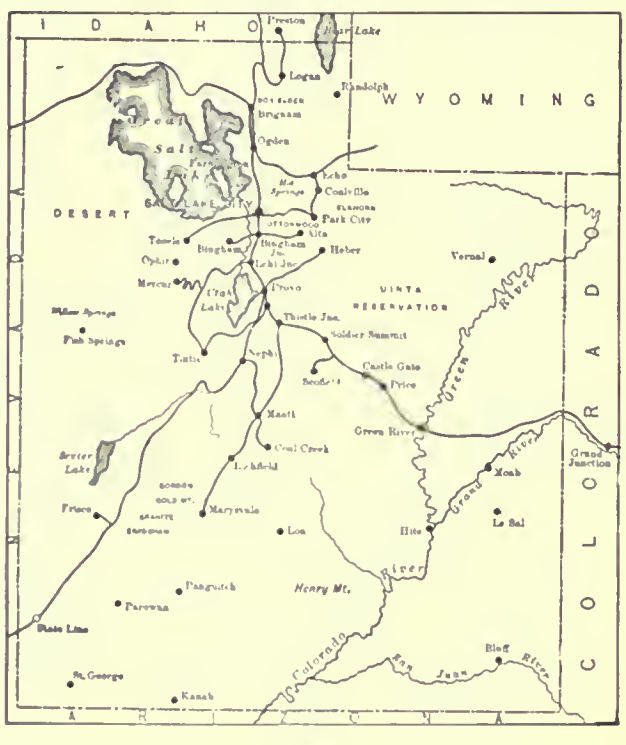
SALT LAKE, UTAH.

The Ontario Adit.—Ohio Copper Co.'s New Mill.—Utah Copper Co.'s Output.—Bond Issue.—Ogden Smelter.—Litigation Settled.—Utah Consolidated Resumes Shipments.

According to reports just received, the water in the Ontario No. 3 shaft at Park City has receded nearly 50 ft. below the 1100-ft. level and is lowering at the rate of nearly 4 ft. per day. The management of the Ontario Silver Mining Co. considers this to be positive proof that the last of the obstructions in the drainage adit have been found and that it is a matter of only a short time until the avenue will have been restored to its former usefulness. Water is flowing from four drill-holes from a parallel drift to the main channel at the rate of 5000 gal. per min. The adit was closed by caves just about three years ago.

The Ohio Copper Co., at a special meeting of shareholders at Portland, Me., authorized an increase in the capital stock from 1,000,000 to 1,500,000 shares, of the par value of $10. It is proposed to issue $2,000,000 worth of bonds, redeemable in stock at $10 per share any time prior to September, 1912. The funds derived from this issue will pay for the mill now under construction, with enough additional to build a second unit, thereby providing facilities for the treatment of 4000 tons of ore daily. In a report submitted by D. McVichie the actual amount of developed ore in the Ohio mine at Bingham is placed at 3,746,165 tons, of an average copper content of 1.6%; with 3,238,616 tons additional classed as probable ore above the 500 level, of the average copper content of 1.5%. It is anticipated that the best orebodies lie below this level and development at depth is now in progress. The mine is to be connected with the Mascotte tunnel from the Dalton & Lark mine at a depth of nearly 1000 ft., and it is expected that this work will be completed within the next 60 or 90 days. The Ohio ores concentrate on a basis of 18 tons into one. A noticeable feature about the Ohio mine is the increase in gold as depth is attained. In the construction of the mill, $653,579 has already been expended; the equipment includes two 24 by 16 in. jaw-crushers, four 20 by 6 in. jaw-crushers, eight 24 by 15 in. rolls, 144 jigs, sixteen 7-ft. Chilean mills, and 382 Wilfley tables. The slime plant will be equipped with 72 Wilfley slime-tables and 180 Callow tanks.

The output of the Utah Copper Co. during January was 130,000 tons of ore; this was treated at the company's mills at Garfield and Bingham, the



Utah.

latter handling 700 tons per day, 3,200,000 lb. copper being obtained. The ninth section of the Garfield mill will be in commission before the end of the month.——The mill of the Boston Consolidated Co., at Garfield, is reported to be working satisfactorily. Three 250-ton sections are in commission and the fourth will be ready this week.——The Utah Copper Co. has filed amended articles of incorporation with the Secretary of State, the capital stock having been increased to $7,500,000. The bond issue of $1,500,000 authorized at a special meeting of stockholders recently, according to advices received from the East, has been fully subscribed.

Owing to the numerous protests made by farmers residing in Weber and Boxelder counties, the Utah Mine Owners' Association has abandoned the project of making Ogden the centre for an independent smelter. Accordingly, the option on the plant of the Utah Smelting Co. will not be exercised.——All litigation having been brought to an end over title to the Snowflake and Mountainview groups in the Gold Springs district, Iron county, a syndicate has organized the Buck Mountain Gold Mines Co., with a capital stock of 5,000,000 shares of the par value of $1 each. Plans are being made to erect a mill

to treat 100 tons of ore daily, the plant to be almost a duplicate of the one now being operated by the Jenny Gold Mining Co., in the same district. Charles A. Short, of the Short & Elliott Co. of Salt Lake, is manager.

The Utah Consolidated Mining Co., operating at Bingham, will resume ore shipments on the 15th inst. to the extent of 800 tons daily, the product to go to the Garfield smelter of the American Smelting & Refining Co. for treatment, under a contract which is to run for one year with the privilege of two. J. B. Risque, the manager, says there has been no change in the plans of the Utah Consolidated in regard to the building of its proposed new smelter in Tooele county. However, there will be no hurry to start construction.

ROSSLAND, BRITISH COLUMBIA.

Operations of the Granby.—Possible Consolidations. —The Rossland Mines.—The Lead Bounty.

The Granby is the only mining company in this district that has shown any material progress during the past week. They have increased their operations since the beginning of the year step by step until they are now shipping 22,000 tons of ore per week from the mines to the smelter, where they have their full battery of eight furnaces at work. It is likely that the furnaces will be enlarged in the early summer, increasing their present capacity (3000 tons) by about 25%. There are now 800 or 900 men employed at the Granby mines and smelter, but there is still a small surplus of labor in the Boundary.

The annual meeting of the Dominion Copper Co. did not lead to the resumption of work and there are rumors that the Granby may absorb this company and the B. C. Copper Co. Some color is given to these reports by the recent examination of these other mines by Granby men. The officers of the Granby maintain there is nothing in this gossip, but to the average observer the plan seems feasible, as it would enable them to operate these mines at a good profit, even with copper as low as it is now. It is also stated that the Consolidated Co. has its eye on the Dominion property. As the Consolidated smelter at Trail is now treating ore from the Snowshoe mine at a profit, that carries only 1.4% copper, $1.50 gold, and 23c. silver, the same thing may be said of them as of the Granby.

The big companies here are recognizing the value of extending their operations over a broader field. The Granby is doing development work on good properties in the Similkameen and Rossland; the Consolidated at Rossland, Trail, Moyie, Phoenix, Sloean; the Le Roi No. 2 at Rossland and Silverton, etc. This is partly necessitated by the low-grade character of the gold-copper ore, to treat which successfully it is necessary to have a higher grade of ore for flux, and it of course also tends to more economical mining.

The Maple Leaf group has been bonded to New York capitalists and a small force of men put to work. At the Jewel mine they have a large body of gold ore blocked out that will require special metallurgical treatment. The superintendent is now at Denver seeking a fit process and making tests.

The Rossland mines shipped 5885 tons of gold-copper ore during the past week. The total for the year to date is 28,688 tons. The Consolidated Co. is opening up a fine lot of ore in the lower workings of their mine. From the War Eagle workings they recently extracted a 100-ton lot that ran $50 in gold, which is high for this camp. One newly developed orebody is 35 ft. wide, another is 65 ft. across.

Work is progressing at the Le Roi, Giant-California, and Evening Star. At the Blue Bird they have struck a silver-lead lode that runs $50 per ton. This being in the mooted South Belt, it is hoped that the strike will prove of importance and aid in the opening up of this portion of the camp.

The Hewitt mines, near Silverton, recently shipped five cars of ore running 141.6 oz. silver and 5% lead. They have a quantity of concentrating ore blocked out. This company has made many improvements in the handling of its product and is working steadily. Delegates have been sent East to present the case of silver-lead mining interests here in a proper light to the Government, in the matter of a further extension of the bounty on lead.

MEXICO.

Refinery Changes Hands.—Fresh Zinc-Shaving.

On the first of February the clean-up and inventory was completed at the Nonoalco refinery, Mexico City, of the National Metal Co., and the plant turned over to the Metal Refining Co. (Societé Affinage de Metaux), with whom the terms of sale by the former company were arranged just before the close of 1907. This refinery was started by the National Metal Co. in December, 1905, for the electrolytic refining of silver and gold from doré bars and cyanide and sulphide precipitate. The company confined itself wholly to custom work, filling a long-felt want, and in a short time had contracted almost the entire output of the great camps of Pachuca, El Oro, and Guanajuato, and was continually adding others, until its purchase and production were well in excess of 500,000 oz. fine silver and 25,000 oz. fine gold per month. Early last year the necessity of a new and large refinery became evident, and ground was purchased for this purpose. But the continued growth of the business and the consequent large amount of money locked up therein was a great tax upon the company's finances, so that when early last fall the strong French company appeared upon the scene and made a splendid offer to the National Metal Co. for its business, negotiations were entered into, and as it was soon seen that the French company would enter the field as a strong competitor if the sale was not made, the deal was finally consummated and the property turned over as stated above. Pending the inventory and clean-up, the bullion has been shipped to the new company's correspondents in France, but now work will be resumed at the Nonoalco plant, which will continue in operation until the completion of the new plant which the French company has already started at Cypress St., Santa Maria, Mexico City. The home office of the Metal Refining Co. is at 56 Provence St., Paris, and it is closely allied with Mirabaud et Cie. and the Comptoir Lyon Allemond. The Mexican directors are Hugo Scherrer, Jr., Guillermo Brockman, and J. Seekbach of Seekbach & Co., all of whom have for some years been large bullion dealers. During the two years that the National Metal Co. was in the refinery business, it handled something over 40,000,000 pesos worth of bullion, and deserves great credit for the work done; now, though not compelled to remain out of the refinery business, it will undoubtedly again resume the ore-buying that it had practically abandoned in order to devote its time and capital to the refinery.—— What promises to be a very successful enterprise and one that should be welcomed by every cyanide man, is that established by A. G. Baldwin, of Los Angeles, at Nonoalco, Mexico City. Here Mr. Baldwin has erected a small plant with the most modern machinery for the manufacture of zinc-shaving, whence the mill-man who has not his own plant may obtain without delay and for immediate shipment absolutly fresh and clean zinc-shaving, obviating the long waits for shipments from the States.

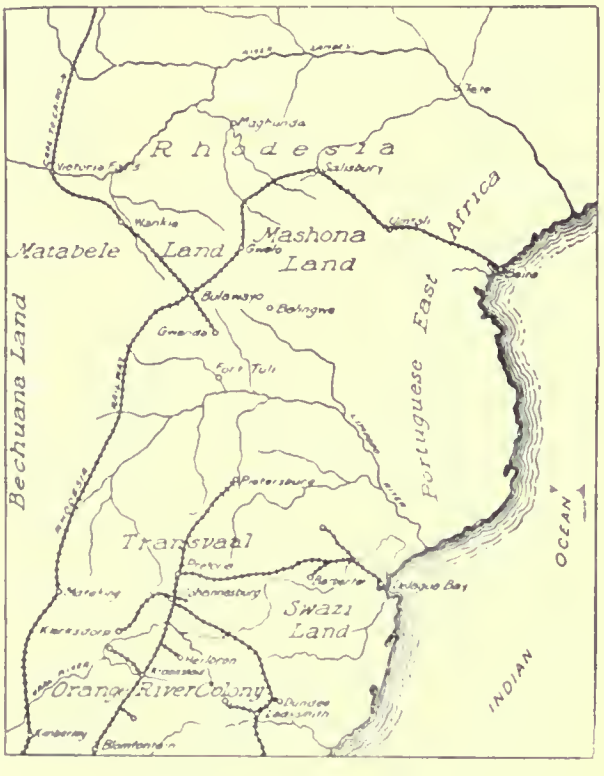
JOHANNESBURG, TRANSVAAL.

A Bold Hold-up.—Sunday Work in the Stamp-Mills. —State Mining Engineer.—Good Dividends.

Last week a desperate attempt was made by two highwaymen to hold up the officials of the Witwatersrand mine on their way to the bank with bullion valued at £12,000. The robbers were quite up-to-date, for they made the attempt by blocking the road with their motor-car. The officials had no idea that the men in the motor-car were highwaymen, until one of them was looking down the barrel of a revolver held by one of the robbers. As the officials did not appear anxious to give up the bullion, the robber pulled the trigger, but strange to say, the pin failed to fire the cartridge. At once, Mr. Allen, one of the officials, shot his antagonist through the stomach. The men were novices at the game, and ran to their motor-car. The wounded man soon became unconscious through loss of blood, and as the other fellow did not know how to manipulate the car he ran off across the veldt. Before night both men were captured, and a few days later the wounded man died. He was a resident of Johannesburg, a married man known to many people. It is stated that the other man was formerly on the staff of one of the mines. Times got hard with them, and this appears to have been their first crime. If it be true that 'nothing succeeds like success,' the reverse must be true that 'nothing fails like failure.' The complete failure of the highwaymen, and the death of one of them, will do more to discourage other desperadoes than any moralizing. There have been numerous attempts since the war to hold up banks and mines, but the failures have outnumbered the successes. On one or two occasions success has been due to having a confederate employed on the mine. The incident at the Witwatersrand will make people more careful in future, for although the gold is insured against such accidents, it is a sad thing for highwaymen to get away with, say, £12,000.

A week or so ago, the Comission now sitting to inquire into the workings of the mines received a deputation from the Witwatersrand Church Council, who gave evidence on the subject of Sunday work. As is well known, the Sunday law in this country is one of the best in the world, and compared with the laws in the Western States, where apparently no notice is taken of Sunday in the mining centres, the Transvaal is very well off. Only certain specified work is allowed on Sundays, and a contravention of the regulation is punishable by a fine as high as £75. The law allows the running of stamp-mills on Sundays. The delegation from the Council pleads that this too be prohibited. When it was pointed out the loss, especially to the poorer mines, that this new regulation would cause, the delegation suggested the construction of more stamps, but did not guarantee the capital to carry it out. Most people, especially church people, thoroughly sympathize with the delegation in their desire to do something for the mine employees, but the general opinion is that the very few men who work on Sundays are treated generously, and there is no necessity to change the law. It is improbable therefore that the stamp-mills will cease crushing on Sundays.

Many sarcastic comments have been made over the action of the Government in dismissing the Government Mining Engineer, H. Weldon, who for several years has successfully filled this important post. Mr. Weldon is well qualified for the post, both by training and by experience in this country. But he has a failing that Het Volk cannot readily forgive—he is a typical Englishman. It has been apparent for some time that he would be ousted from his appointment, and people have been amused to see how the Government would bring it about. There was little surprise, therefore, when it was announced



Map of the African Goldfields.

that Mr. Weldon, who rightly declined to resign, preferring to force the Government to dismiss him, was to be superceded by R. N. Kotze, who possesses the first qualification for this post, namely a good Dutch name and ancestry. Fortunately, Mr. Kotze is also a well trained engineer, and is about the only member of Het Volk that knows anything about mining. Mr. Kotze has been a consulting engineer in Johannesburg for some time, and knows the Rand well. Mr. Weldon's services will not be altogether lost to the industry, for he has consented to take the position of Chief Inspector of Mines.

The excellent dividends being announced in the daily papers are doing something to restore confidence in the mining industry. Some of the rich mines are paying out amounts this year somewhat higher than usual, while most of the less fortunate mines are announcing dividends above last year's declaration. There is no doubt that every effort is being made to woo capital back to the Transvaal, and the leaders are going the best way about it, namely by reducing working costs and thereby increasing the interest paid to shareholders.

Concentrates.

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

In a machine devised for surveying boreholes, the magnetic needle is clamped by the air pressure caused by a detonation of a cartridge.

Chilled-steel shot of extreme hardness, adapted to replace diamonds in drilling through many formations, is made by spraying or atomizing molten steel into cold water, thereby chilling it instantly.

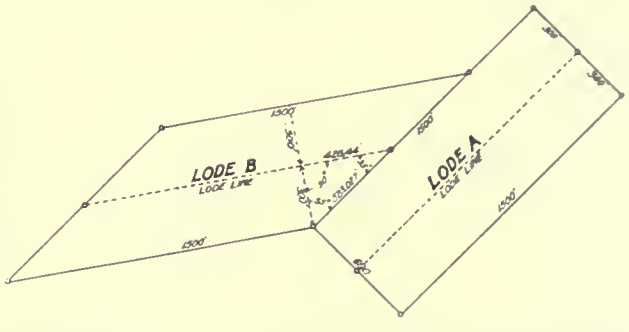
Cadmium is an important constituent in the zinc ore of the Joplin district in Missouri; mine-owners there engaged in the production of the metal in the beginning of 1907 and probably recovered during the year between 7000 and 8000 kg. of it.

Candles and lanterns, if handled with great care, will burn in air containing 3% carbon dioxide, but give very little light. They are extinguished by a very slight jar if more than 2% is present. An acetylene lamp will burn in still air containing a higher percentage of carbon dioxide than a candle will stand, but the flame becomes yellow and finally almost blue. In fighting fire in a mine it is necessary to have electric lights to work by where carbon dioxide is present in the proportion of 2% or more of the air.

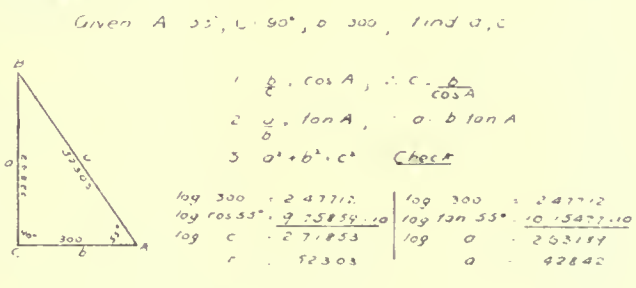
Dynamite is a peculiar and unreliable substance and must be handled with utmost care. At this season of the year there are always many accidents from dynamite explosions, nearly all of them resulting from carelessness or ignorance on the part of the men handling such explosives. Steam-shovel men are frequently called upon to furnish hot water with which to thaw out frozen dynamite. Water for this purpose should never be drawn directly from the boiler, as the temperature of the water in the boiler, which is generally more than 212° F. is too high for safety. A better way is to take it from the overflow in the inspirator, as such water is only about 60 or 70°, and while it takes a little longer to thaw the dynamite, it is much safer, and may be the means of preventing many accidents.

A prejudice exists among the prospect-owners of northwestern California against assaying as a means of determining the value of their properties. As most of the gold is in a free state they depend on the use of the mortar and gold-pan to give them an idea of the approximate amount of gold per ton of rock. Here is how this careless method worked out in a case in Trinity county: About five years ago several men who had considerable experience in a portion of Shasta county where the gold is only partly in a free state, bonded a prospect in the Coffee Creek district of Trinity county. They did not have any of the quartz assayed, but after much panning they concluded that they had a large vein of ore that carried $10 gold per ton. Then they organized a company and proceeded to erect a 10-stamp mill. When one 5-stamp battery was completed they made a test run of several weeks' length. It is doubtful that they even made a clean-up. At any rate the operation suddenly collapsed. These men had made the mistake of judging a Trinity county pan prospect by a Shasta county standard. This is not an isolated case; careful sampling and assaying are prime requisites to success in gold-quartz mining even in a district in which nearly all the gold is in a free state.

The locations embracing lodes A and B in the form on the diagram are properly made. The angle at which end lines cross a lode is immaterial so long as the lines are parallel, and the claim as located does not exceed the statutory length or width. The width is the perpendicular distance between two side-lines, not necessarily the length of the line connecting the



two opposite ends. As to grouping claims for patent purposes, as long as the claims are contiguous the law is satisfied. The Land Department allows patent applicants to exercise their own judgment as to the manner in which the claims join one another. The formula for determining the length of two sides of a triangle where all the angles and the length of the other side is known, is stated and applied as follows:


Given A 33°, C 90°, a 300, find b, c
1 c = a / cos A, ∴ c = a / cos A
2 b = a / a · tan A, ∴ b = a tan A
3 a² + b² = c² Check
log 300 = 2.47712
log cos 33° = 9.75859 - 10
log c = 2.71853
c = 521.03
log 300 = 2.47712
log tan 33° = 10.51927 - 10
log a = 2.99639
a = 428.42

The largest orebodies of the Cripple Creek district, Colorado, consist of a multitude of soft rich seams in hard nearly barren rock. Concentration by any method other than hand sorting is impracticable. When the rock is blasted, a large part of the valuable material in the seams is reduced to an extremely fine powder; another part adheres as crusts to the coarse rock. The fine is screened out and the coarse material hand sorted. At some mines the waste rock discarded by the sorter is washed before being thrown over the dumps, as it has been found that valuable fine adheres to these larger rocks. This sorting, washing and resorting is one of the items which bring the cost of ore production at Cripple Creek higher than in most camps in which other conditions are similar.

Discussion.

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy.

A Conical Tube-Mill.

The Editor:

Sir—Some twelve years ago I conducted my first experiment with the tube-mill, in the endeavor to crush a rich slag containing a quantity of matte for wet concentration, after 6 by 42 in. high-speed rolls failed to do the work required. With the rolls the economic point was reached at 16 mesh. The tube-mill was brought to my attention as the Murphy 'barrel,' and I was prevailed upon to give it a trial as a last resort. The result astonished me; but it carried the work to the other extreme, and produced a slime which, as far as economic results were concerned, placed me in almost the same position as did the under-grinding by the rolls. While the work in this instance was costly, even though I made a gravity concentrate of about $200 per ton, the experiment in the form of experience was worth the price paid. I realized the great capacity of the device, and also realized that it would not fill the requirements for ordinary concentration on account of its sliming. As cyanidation was then in an undeveloped stage, the experiment was charged to experience, and five or six years later it was utilized as a valuable asset. In the meantime, other engineers adapted the developed tube, or pebble-mill, to cyanidation, until today it is accepted as one of the necessary appliances for the recovery of millions of dollars per year, where margins of profit are sometimes limited to cents per ton, instead of dollars.

It is a question, whether even now the full possibilities of the device have been given the consideration which it deserves as a gradual reduction apparatus. The tube has been fed and choked with undersized material, but it has gone on "doing business" in spite of abuse. Its great economic possibilities should have been the subject of more thought and experiment.

The pioneer in any line generally has to pay for his experience in cash or its equivalent, or as a sacrifice due to the criticism of his co-workers. In my own case it was with considerable temerity that I carried out the theory in a new device employing the tube-mill principle for crushing. The idea developed into laboratory tests and the laboratory tests into a practical working machine, that is, my purpose was to clear the anvil cushioned with the remains of previous work, before placing upon it the next task under consideration, an idea often and ably expounded by practitioners such as Philip Argall, Ernest A. Hersam, and others of their class. While I do not claim to have achieved the acme of their requirements or of my hopes, still I feel that in developing and bringing out the conical pebble-mill, I have accomplished not only a first step, but a stride toward filling a long felt want.

The first machine I devised on this principle, was for the extraction of sapphires from a soft tufaceous rock. To crush the rock, meant crushing the sapphires. The satisfactory accomplishment of this end was finally realized by employing a mill comprised of two cones, using the coarse lumps of the sapphire rock as grinders; a method that I had previously used in the ball-mill, when grinding without the intervention of grinding-balls. The result was that the sapphires dropped from their matrix like plums from a plum pudding. Then the question arose, as to how to get them from the machine. This was contrived by inclining the mill at any angle from the horizontal while revolving, when any particle smaller than the grinding body immediately sought and took up a zone of vertical stratification according to its size rather than its gravity, issuing in a stream from the mill. The result was a mixture of sapphires, quartz, iron pyrite, and other material, from an eighth to a half-inch in diameter. Here another difficulty in separation presented itself, which was finally overcome by employing gravity-jigs to separate the quartz and sapphires, and the Blake static-electric process for the removal of the sulphides.

To claim that sliming and coarse grinding can be accomplished in the same machine, appears to be unreasonable. That it can be done is illustrated by the case of the sapphires, and it is proved by the results accomplished by the conical mill adjusted for fine grinding, in competition with an ordinary tube-mill. The feed for the tube-mill was first crushed by stamps through 25 mesh, while the conical mill heading was the direct product of rolls, of which over 63% was coarser than 20 mesh (from ¼ in. to 20 mesh):

	Mesh	On 40 %	On 60 %	On 80 %	On 100 %	Through 100 %
Conical mill, charge of 2000 lb. pebbles, consuming 15 hp.	Head	75.7	6.6	5.5	2.3	9.5
	Tail	0.0	1.4	5.4	2.5	90.8
Regulation tube-mill, charge of 11,000 lb. pebbles, consuming 48 hp	Head	1.5	13.5	17.0	17.5	53.0
	Tail	0.0	0.5	1.5	2.0	96.5

In this coarse crushing by a pebble-mill, it was realized that we had attained a point which was of far-reaching interest to the metallurgist, even though we had been working with what has been termed a 'freak' machine; but a freak only in so far that it does something the other machine does not—for machines, like men, are freaks when they diverge from the trodden road of common usage.

In the most excellent article by Mr. Ernest A. Hersam in the MINING AND SCIENTIFIC PRESS of November 16, commenting upon the loss of power due to friction or the interference of ore particles among each other, he says: "All such friction is lessened by a free discharge of the crushed ore as it becomes reduced to the size wanted. This condition is difficult to obtain. To crush the ore the masses must be retained between the approaching surfaces that administer the force. But while too great an amplitude in the motion of the pressure surfaces tends uselessly to compress the fragments, grinding these one upon another, and distributing the force in many directions—too little amplitude, on the other hand, fails to do more than deform some of the particles, and failing to break these, it wastes what-

ever energy is so expended." These remarks not only apply to the crusher, stamp, or roll, but I believe more particularly fit the case of the ordinary tube or pebble-mill, whose consumption of power is so much greater than the work performed.

The tube-mill is ordinarily fed with material already ground to pass 20 mesh or finer; in which case fully 50% has already reached the maximum fineness desired, and therefore is a frictional interference to subsequent work. This work has been accomplished at a great expense of power; figuratively, it has been done and over-done; a sledge-hammer has been employed to drive a tack. To illustrate: A 1000 lb. stamp, dropping upon a 1 lb. piece of ore with a 6-in. drop delivers a blow of 500 ft. lb., or a relation of 1 : 500. In the subsequent crushing of the particle of the 1 lb. piece, the ratio is raised enormously. In the case of a 1 lb. pebble rolling down a rough 2 or 3-ft. incline, it would be pure supposition to figure the foot-pounds exerted;

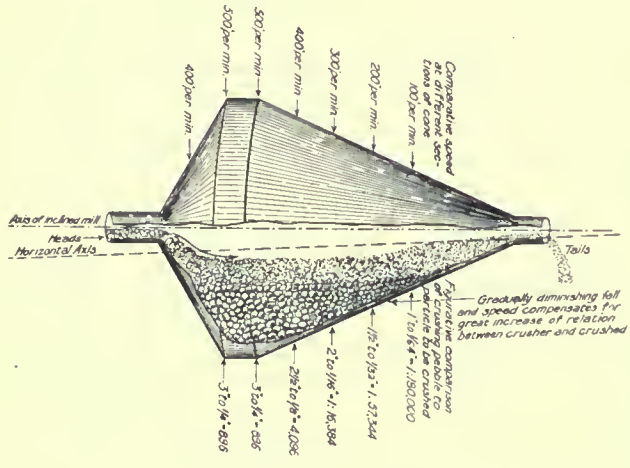

400 per min
500 per min
500 per min
400 per min
300 per min
200 per min
100 per min
Comparative speed at different sections of cone
Axis of inclined mill
Heads
Horizontal Axis
Tails
Gradually diminishing fall and speed compensates for great increase of relation between crusher and crushed
Relative comparison of crushing pebble to particle to be crushed
1 to 64 = 1,980,000
1½ to 1 = 1,57,344
2 to 1 = 16,384
2½ to 1 = 4,096
3 to 1 = 896
3 to 1

Diagram Illustrating Grinding Action.

but assuming that it expends a relative amount of force, less the friction, and acting upon a mass a quarter-inch in diameter, the relation by weight will be 1 : 1024. But you cannot get this force successfully applied in either case unless you remove the interference due to the previously crushed material. In the case of the conical mill, the crushing bodies employed (pebbles) are of different diameters, such as naturally results from the wearing of the pebbles in their action upon the material to be ground; normal sizes being replaced as required. The larger sizes seek and maintain a relative position at the base of the cone or cylindrical part of the mill, where they act upon the newly fed particles. These particles, after being crushed, immediately pass forward to the next succession of sizes of pebbles, which in their turn act upon the second reduction, and so on up the incline of the cone, where a gradual reduction of applied forces takes place through the smaller sizes of crushing mediums, and less impactive force, due to the decreased peripheral speed.

An idea of these relations of crushing bodies to the particles to be crushed, can better relatively be understood by a classification of sizes of crushing masses, to size of particles to be crushed, as follows:

A 3 in. pebble is to a ¼ in. particle as 1 : 896
A 2½ in. pebble is to a ⅛ in. particle as 1 : 4096
A 2 in. pebble is to a 1/16 in. particle as 1 : 16.384
A 1½ in. pebble is to a 1/32 in. particle as 1 : 57.344
A 1 in. pebble is to a 1/64 in. particle as 1 : 180.000

Thus the crushing ability of the smaller pebble, is inverse to its size, and shows the waste of power in employing unnecessarily large bodies for work performed in the regulation cylindrical tube-mill, where classification does not take place, but a large proportion of the power is consumed in friction between pebbles and material already as fine as desired.

If a practical demonstration is desired of the sizing action that takes place in the cone outlet of the conical mill, I suggest as a simple experiment, with material on hand in almost any laboratory, the placing together of two glass funnels (preferably ribbed inside) with base to base, holding same together with adhesive tape, first partly filling one of the funnels with almost any material like fine dry sand to coarse gravel: revolve this apparatus at a slight angle from the horizontal, and watch the result. Explain it, if you can.

H. W. Hardinge.

New York, January 20.

Dam Made of Slag.

The Editor:

Sir—As mention has been made lately in your journal of a couple of dams built of slag, possibly a report of a new one may be of interest. The Union Copper Mining Co. of Copperopolis, California, was in need of a dam below the concentrator. The company's smelter is so situated that slag from the reverberatory furnace could be used in the molten state for the construction of the dam. In the past, the slag from the furnace has been removed by running it directly to the dump, in a sand-run about 75 ft. long. By extending this slag-run to a total length of 180 ft., liquid slag could be made to flow to the site of the dam. It is possible to dispose of a large amount of slag by this means, thus economizing the space available for a dump.

First a temporary mud dam was built across the creek and the accumulated water removed by a flume; then two concrete piers, erected on a concrete foundation, were constructed in the bed of the creek to hold the flood-gate. A culvert, 4 ft. square, was extended down the creek from the piers. The sides consist of roughly built walls of brickbats and the top, of a slightly arched bed of earth 8 in. thick at the sides. This bed of earth is supported by a platform of old boards resting on numerous uprights. When the slag has reached a sufficient depth, the boards and supports will be burned out, allowing the earth arch to collapse. It is expected that the brick walls will be washed away, the earth and brickbats being carried down the creek by the winter rains. An arched culvert of slag will be left. The face of the dam is constructed of brickbats laid in mud. A trench was dug down to bedrock of this wall and filled up with slag so as to decrease the possibility of leakage between the slag and the ground. The brick wall will probably fall in when the dam fills with water, leaving a straight face of slag.

No trouble has been experienced in running the slag to the dam in the sand-run. From the mouth of the run, slag is diverted as desired to any portion of the fill. The plan has been to discharge the slag at the face of the dam and allow it to flow down-stream. In this way the highest part of the dam is formed at the face, the slag sloping

from there down the creek. In the above manner we have been able to construct a good permanent dam at very little expense.

HERBERT W. ROSS.

San Francisco, January 14.

The Editor:

Concentration.

Sir—While 'slime' and the 'filter-press' are almost wholly occupying the field of metallurgical research, the 'concentrator man' is resting on past laurels and appears to be satisfied to allow chemistry to invade the field of mechanics. As far as the metallurgy of gold is concerned, except in rare instances, the problem is rather of a mechanical nature than chemical, for gold in ore usually occurs as a mechanical mixture and should be separated by mechanical means, although the original deposition was by chemical agencies. One can hardly imagine that the type of machine represented by the Frue vanner and Willley table is the ultimate product of mechanical genius for the separation of materials of different specific gravities.

While this may be a period of monetary stringency, compelling many of us to wait for better times, we might be using our heads and hands in attempting to solve a method of eliminating the chemical equation from the treatment of gold ores by improving or originating new ideas whereby we might take the slime problem into the realm of mechanics. The mechanic has given us a wellnigh perfect sliming machine, let us finish the job and give the chemist food for thought. We all know that concentration as now practised leaves from a trace to $7 per ton in the tailing from an ordinary ore, in fact, it leaves enough to make it worth while to employ auxiliary processes in order to complete the extraction. Part of the gold is in the form of fine metal that has escaped the plates and concentrators, and part is combined mechanically with sulphides of high specific gravity. Eliminate this loss and our problem is solved. We are not now considering silver or copper ores in which the metals may be in a chemical mixture whose specific gravity may be very near that of the matrix.

We have tried concentrating slimed ores on belt and table machines with water as the suspensory medium with very indifferent success, concentration in oil likewise with partial success, also flotation by means of gas, as well as air as a medium. Of these different processes I am inclined to believe the simplest and the most promising to be the last named. I am aware that various machines using air concentration are on the market, varying in point of effectiveness from the crude 'dry washer' of the desert prospector to the more delicate machines utilizing an air-blast on sized material. So far these have not solved the problem but, nevertheless, I am inclined to believe that the combination of fine grinding and air-concentration has many excellent features. We may at the outset use the results of our experience in practical concentration and try to formulate some ideas to govern us in solving the problem.

The first problem is perfect sizing. With a dry slime, graded screens will accomplish the result; with a wet ore, hydraulic sizing must be resorted to; for the solution of this problem may be with dry or damp ore in air or some other gas, so we must not overlook possible contingencies and especially any knowledge that will help us. My experience has been that the flat table is a better machine for concentrating mineral from slimed ores than the belt type and that to obtain good results hydraulic sizing as a preliminary process is necessary, but has not this hydraulic sizing been neglected? If we are to size at all, why not do it well? The inverted pyramid and cone are the general appliances used for the purpose, but an important principle connected thereto has had insufficient attention. I refer to the decreased upward motion of the water current as it nears the top of the appliance. I am aware that at the Smuggler mill at Aspen the management has a patent on a sizer embodying this feature. The remedy is a contraction of the annular space between an inner cone and the conic receptacle so that the rising water with suspended mineral will encounter a constant force, allowing the minerals of a given specific gravity time to settle before being carried over into the tailing. This is not sizing in its simplest form, it is concentrating and sizing, for fine metal or mineral will be carried over, but if pushed to a logical conclusion, with the annular space proportional to all the other factors, we may have a good concentrator. Now apply the principle to air-concentration and with all the factors constant we may imagine a state of equilibrium in the air-vessel, with the light particles in the upper stratum and the heavy material in the lowest. With coarse particles the condition would be impossible, but the 'fine grinder' has provided us with a very fine product that possibly has unconsciously solved or indicated the direction of our search, so let us use this fine material and endeavor to compete with the cyanide man.

ALGERNON DEL MAR.

San Francisco, January 19.

A Correction.

The Editor:

Sir—We note an article in your issue of February 1, on 'Drills for Stoping,' by Algernon Del Mar, and we certainly take exception to the remarks that he makes relative to the Hardsoeg drill. Beginning at the sixth line, he states that the drill is not so constructed that the air-pressure keeps the drill up to its work.

In view of the fact that the Hardsoeg company is the inventor of the air-feed attachment of the air-hammer drills, it seems a little hard to have a statement like this go before the public. The Hardsoeg company builds fully twice as many air-feed types of drills as any other manufacturer.

We enclose you their catalogue so that you may see for yourself. Such statements as this coming from Mr. Del Mar tend to do our business harm. We advertise and spend considerable money to have the public understand what the Hardsoeg people do build, and particularly the air-feed machines. Of course, it is evident that Mr. Del Mar has never come in contact with the air-feed drill of the Hardsoeg Co. or else he would not make such statements.

RIX COMPRESSED AIR & DRILL CO.

San Francisco, February 4.

[The catalogue, Bulletin No. 10 of the Hardsoeg Wonder Drill Co., does contain illustrations of air-feed drills on pages 8, 9, and 10 of that bulletin.—Editor.]

An oil pipe line has been built for transporting California oil across the Isthmus of Panama; its diameter is 8 in. and its length is 51 miles.

The deepest borehole put down for coal in Great Britain was completed during 1907; it attained a depth of 4531 feet.

DIFFUSION AS A FACTOR IN ORE DEPOSITION

Written for the MINING AND SCIENTIFIC PRESS
By COURTENAY DE KALB.

In an able paper* on 'Metallic Sulphides in the Tuffs of Santo Domingo,' Mr. F. Lynwood Garrison raises an interesting question as to the genesis of certain sulphide concentrations in un-fissured masses of an approximately homogeneous tuff. Orebodies of this type large enough to admit of economical exploitation, are rare, but the phenomenon of such segregations or concentrations is not uncommon, and the cause of it merits further consideration than it has received by geologists. In certain lead districts, for example, in southeast Missouri, the occurrence of detached masses of galena in unfractured limestone, entirely disconnected with either joints or bedding planes, is not unfrequently observed. Similarly, concretions of carbonate of lime, or of hydrated iron oxides, in sandstone are found in many places. The latter undoubtedly belong to the same type of segregation as the galena masses mentioned, and as the sulphide concentration described by Mr. Garrison, and they are peculiarly suggestive of the genetic forces operating, because they so frequently assume an approximately spherical form. They point to a force operating or tending to operate equally from all directions toward a common centre. This again demands immobility of the solution or ground-water with which the capillary or sub-capillary spaces of the rock were filled at the time of such concretionary growth. It is interesting to note that sandstones containing concretions do not present these uniformly spherical in shape; ellipsoidal, lenticular, and irregular forms are always common, although spheroids may predominate. Where concretionary sandstones are exposed to view the region has in most cases been elevated, and subsequently eroded. Hence the original water-table has been lowered, and such water as the rocks contain is true 'water of imbibition,' and is subject to capillary flow due partly to pressure (hydraulic head), and partly to evaporation, which latter calls into action the powerful force of capillary attraction, which is capable, in the case of sub-capillary openings of 0.0002 mm. diameter, of lifting water against gravity to a height of 166 m. Such elevation of rocks then, causes capillary flow of water through them, which takes place both vertically downward and upward, and to a certain extent horizontally toward hillsides. In sandstone beds where concretions exist, and under the subsequent conditions described, it almost invariably happens that accumulations of calcite, selenite, and limonite, one or all, according to circumstances, will be found where the sandstone rests upon an impervious bed of shale, and to a lesser degree, though sometimes in large aggregations, as a subsoil crust upon the sandstone on the tops and sides of the hills.† These phenomena are observable throughout the uplifted Tertiary strata of California. The lower mineral accumulations are due to the downward leaching of the sandstones under normal gravity flowage of the solutions; the upward and lateral concentrations represent deposition by evaporation during the long dry seasons, the contributions being maintained by flow induced by capillary attraction to replace the water evaporated. The interestingly pertinent point in all this is that the later leaching and concentration has not been at the expense of the previously formed concretions.

By laboratory experimentation it was long ago demonstrated that in a concentrated solution of a salt containing immersed crystals of the same salt, the largest crystal will grow at the expense of the smaller until the small ones have been entirely dissolved and re-crystallized. This force of crystallization has been imperfectly investigated, but it is a force (having power to cause simple migration of salts, without diffusion, and without movement of the solution) with which we have to reckon in nature, and the influence of it in helping to effect mineral segregation in rocks may be very great. It has probably been operative in the cases of the concretions in sandstone and of the galena concentrations in the limestone, although in the latter it has been complicated with metasomatic replacement, while in the sandstone concretions the sand grains have merely been cemented by a deposition of the lime or iron salts in the interstitial spaces.

The principle of crystal-growth referred to demands concentration of the solution as a preceden condition. The saturation point for any salt depends upon pressure, temperature, and other salts and gases in solution, and is consequently subject to wide variations for any given salt. A solvent in contact with a salt will become saturated, and will then promptly proceed to diffuse the solute in accordance with the well known laws of osmotic pressure. This will continue until homogeneity has been established throughout a solvent of equal temperature. The osmotic pressure is a function of the concentration of the solution but if the solution is accompanied by ionization the pressure is increased. Moreover, by Soret's principle, the concentration increases toward the cooler portion of the solution.

We have here available, competent forces for the migration of salts, quite independently of any movement of the solutions themselves, within limits of distance yet to be determined by experiment, and also competent (in the case of saturated solutions) of producing growths of crystalline masses which could result in such concentrations of minerals as are often found in rocks. The amount of water contained in sub-capillary openings is small relatively to the solid mass of the rock, while the area

*MINING AND SCIENTIFIC PRESS, September 7, 1907.

†Since writing the above, corroborative observations have come to my attention in an interesting and able Bulletin (No. 35) of the U. S. Department of Agriculture, on 'Alkali Soils of the United States,' by Clarence W. Dorsey, as follows (p. 14): "*The greatest movement of alkali salts is due to capillarity which operates through surface tension.* When water moves by surface tension the films around the grains move. As soon as the gravity water has drained away, the movements become entirely by surface tension. A loss of water due to evaporation changes the curvature of the water films and starts a capillary movement toward the point where the evaporation takes place. But when water moves by capillary action it is the water in the smaller spaces that moves, and not the water which is in the larger non-capillary spaces. Therefore, the water which was drawn back into the capillary spaces, and which carried some of the alkali salts as it flowed down into the soil starts upward and carries with it the salts in solution. * * * * Any evaporation which occurs must take place within the soil at the top of the capillary column, the water vapor escaping by diffusion through the layer of the dry soil above. Recent determinations made in the laboratory of this Bureau have shown that an evaporation of this kind does take place within the soil. Since dissolved salts cannot rise above the point where evaporation is taking place, an accumulation of salts must take place within the soil at the upper end of this capillary column."—AUTHOR.

of contact between the solution and the particles of the rock is correspondingly enormous. Hence a condition of saturation of the solution with reference to the soluble mineral matter present would not seem to be difficult of attainment. Sub-capillarity is usually said to exist where the maximum diameter of the open spaces is 0.0012 mm. and the openings in most close-textured rocks are less than this, and the area of contact of the solution with the enclosing wall increases inversely as the size of the opening.

Flow of solutions through capillary channels takes place readily under favorable conditions, but flow through sub-capillary openings is greatly reduced, the retardation increasing rapidly with decrease in the diameters of the spaces, until at a diameter of 0.0002 mm. it is practically nil. The entire quantity of water in the sub-capillary spaces is probably within the limit of molecular attraction of the wall (assumed by Quincke to be about 0.00005 mm., although manifestly it can not be a constant) and this practically precludes sub-capillary circulation under deep-seated conditions. Flow of water is also retarded by an increase in the amount of the solute, thus giving another reason for deeming it questionable whether close-textured rocks below the level of permanent ground-water are capable of contributing appreciable additions to the circulation through relatively open channels with which they may be in contact, except through ramifying capillary openings, shrinkage cracks, shear planes, and other spaces of diseission, exceeding in diameter or width twice the distance to which molecular attraction, that is, surface tension, may exert its influence. But this would not seem to preclude the solutions contained in rock masses, the porosity of which is reduced to sub-capillary dimensions, from playing an important part in the re-arrangement and concentration of minerals within them by diffusion. This might in some cases result in the formation of ore-bodies of workable size.

While in the foregoing argument osmotic pressure has been considered as a means for facilitating concentration by the growth of larger crystals at the expense of smaller ones, it is noted that where metasomasis occurs osmotic pressure is capable, without necessary movement of the solution itself, of contributing material to continue the reactions, and that for this office saturation of the solution is not essential. In fact, ionization, which obtains where such chemical interchange takes place, is a phenomenon occurring most generally, and to a greater extent, in dilute solutions. By such means it may be possible to explain the peculiar conditions observed by Mr. Garrison.

AN INTERESTING USE of paper is in the making of gas-pipes. Manila paper cut in strips, as wide as the length of the pipe to be made, is put into a receiver filled with fused asphalt, and rolled solidly and uniformly around a rod or core of iron until the desired thickness is obtained. After the pipe, thus produced, has been submitted to a heavy pressure, the exterior is covered with sand, and the whole cooled in water. The core is then removed, and the outer surface covered with a waterproof product.

Decisions Relating to Mining.

Specially reported for the MINING AND SCIENTIFIC PRESS.

The superintendent of the mine directed a miner to work in a room adjoining a new entry, which entry was the only means of access to the room where the miner was directed to work; the superintendent further directed the miner to get empty cars at a switch in such entry leading to an adjoining room. While the miner was in such entry in the discharge of the duty which he was directed to do, he was injured by falling rock from the roof of such entry, which had not been properly supported. In an action for such injuries the mine owner was estopped to claim that it was not liable for the reason that it had not accepted and did not control such entry.

Garard *v.* Manufacturers' Coal Co. (Mo.) 105 S.W. 767 (Nov. '07).

A miner was directed to go through an entry down to the switch in front of a particular room in the mine to get an empty car. While opposite such room he heard a cracking of rock in the neck of such room, and warned a miner working therein to look out that there was danger. Not finding a car he started to return and when six or eight feet from the room where the other miner was working, a rock from the roof of the entry fell and injured him. He neither heard nor saw any indications of danger in the entry, but did see and hear the chipping and cracking in the neck of the other room. In an action for such injuries, it was held that the finding of the jury that the miner was not guilty of contributory negligence would not be disturbed.

Garard *v.* Manufacturers' Coal Co. (Mo.) 105 S.W. 767 (Nov. '07).

The lessee in a lease of land for mining oil and gas was enjoined from removing property placed on the land by him, where such lease was taken by him as a matter of speculation, and he did nothing until other parties acting under a prior lease commenced prospecting for oil and gas, and after a temporary injunction against such parties, the lessee went on the land and began prospecting over the protest of the land owner.

Bruner *v.* Hicks (Ill.) 82 N.E. 888 (Oct. '07).

A ground foreman in mining operations conducted under the supervision of a general superintendent or manager, is a fellow servant with the miners whose operations he is directing, especially so where his duties were to direct the miners where to set up the drill, direct the shovelers where to shovel, direct the location of the underground tracks, and look after everything underground; and where it was a common practice for him at times to help the workmen who were laboring under him in actual drilling of holes, laying the track, and other such work, and where he was subject to the general orders of the superintendent, and notwithstanding he hired men to work in his department and discharge them, but did not pay their wages.

United Zinc Co. *v.* Wright, 156 Federal 571 (Oct. '07).

A drilling man in a mine was held to have assumed the risk of injury where it was the usual known custom to move the drills by hand up stopes having a practical grade; and he was not relieved from such assumption of risk by reason of a complaint made to the foreman and a promise on his part to secure other appliances for moving the drills, where such foreman had no authority to do so, either actual or apparent, and whose only duty was to report the complaint to the superintendent, under whose direction all the work was conducted, but which he failed to do.

United Zinc Co. *v.* Wright, 156 Federal 571 (Oct. '07).

NATIONAL MINING BUREAU.

Our readers will be interested in reading the text of a joint resolution introduced by Mr. Dick, in the Senate of the United States and reported favorably by the Committee on Mines and Mining. It read:

To provide for the establishment of a Bureau of Mining Technology:

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That there is hereby established in the Department of the Interior the Bureau of Mining Technology, whose purpose shall be to make technologic investigations and reports on methods of mining, extracting, and utilization of the mineral substances of the United States and its noncontiguous territory, with a view to the betterment of the mining industry, the improvement of mine conditions, and the prevention of accidents and the waste of materials.

SEC. 2. That the President, by and with the advice and consent of the Senate, is hereby authorized to appoint a Director of the Bureau of Miuing Technology who shall receive a salary of six thousand dollars.

SEC. 3. That the Secretary of the Interior, with the advice of the said Director, is authorized to appoint such experts and others as shall be necessary to carry out the purposes of this act: *Provided*, That the Director and members of the Bureau of Mining Technology shall make no examinations for private parties or corporations except where such examinations involve the question of public safety.

At the same time a bill was introduced by the same Senator, but the Committee did not endorse it. The bill read:

To provide for a branch of mining technology in the Geological Survey:

Whereas, the mining interests of the United States yielded during the calendar year nineteen hundred and seven an increase to the nation's wealth of nearly two billion dollars; and

Whereas it is desirable that more adequate recognition should be given to the industry, not only by the more extended examination of the geological distribution of the mineral resources of the country, but also by the investigation of mining and metallurgical methods with a view to promote the better utilization and conservation of these mineral resources; therefore

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That the Director of the United States Geological Survey be, and is hereby, authorized, under the direction of the Secretary of the Interior, to extend the examination of mineral resources and products of the United States and its non-contiguous territories so as to include the investigation of all mining and metallurgical methods in so far as such investigations bear upon the more efficient utilization of the material resources of the country, and particularly upon the accidents and dangers of the mining industry.

SEC. 2. That a branch of mining technology be, and is hereby, established in the United States Geological Survey for the purpose of providing for this investigation of mining technology.

SEC. 3. That the Secretary of the Interior shall report to the next Congress.

A discovery of magnetic iron-ore, said to be somewhat similar to the ore from which the Swedish iron and steel is made, is reported to have been made on Crown land on South Island, New Zealand.

The Prospector.

Enquiries sent to this department are answered free of charge, if submitted by subscribers who are not in arrears. The full name and post-office address of the sender must be given, otherwise no answer will be made. Those who are not subscribers must accompany their questions with a fee of $3 for each question. No assays are made.

A specimen of gneiss was sent by S. C., of Santa Barbara.

A specimen of obsidian came from A. J. L., of Salt Lake City.

A specimen of diorite came from P. B., of North Yam Hill, Oregon.

DeY, of Dolomi, Alaska, sends: chlorite, quartz, and magnetite grains.

The three rocks from Arispe, Sonora, sent by A. T. T., are rhyolitic breccia.

A specimen of chloritic gneiss was received from W. E. S., of Quartzite, Arizona.

T. H. O., of Humboldt, Ariz., sends an altered volcanic rock, perhaps a rhyolite tuff.

W. C. McD., of Princeton, B. C., sends: No. 1, black obsidian; No. 2, common opal. Neither of value.

D. G., of Terrazas, Mex., sends: No. 1, quartzite; No. 2, rock too much altered to classify; No. 3, quartzite.

The two specimens received from E. T., of San Antonio, Tex., are: No. 1, altered feldspathic rock; No. 2, volcanic tuff.

R. E. H., of Weaver, Ariz., sends: No. 1, yellow ochre; No. 2, pegmatite; No. 3, chlorite-schist; No. 4 to 6, granitic rock.

The rock sent by E. W. S., of Whitebird, Idaho, is serpentine containing cuprite and chalcocite, and coated with chrysocolla, all copper minerals.

The specimens from Wonder, Nev., marked H. G. G., are: No. 34, biotite-andesite; No. 35, feldspar-porphyry; No. 36, altered rhyolite; No. 37, rhyolite.

The specimens sent by D, Alleghany, Cal., are: No. 1, mica-schist; No. 2, altered schist; No. 3, pyritized talcose schist; No. 4, sulphantimonite of copper with some lead, bournonite.

W. L. H., of Phoenix, Ariz., sends: No. 1, volcanic tuff; No. 2, schist; No. 3, aplite; No. 4, altered volcanic rock; No. 5, hornblende-andesite; No. 6, sedimentary rock; No. 7, metamorphic rock; No. 8, dacite.

The specimens from Fairview, Nev., marked R. O. G., are: No. 18, meta-rhyolite; No. 19, quartzite; No. 20, calcareous shale; No. 21, slate; No. 22, calcareous rock; No. 23, silicious limestone; No. 24, contains gypsum; No. 25, gypsum with earthy limonite; No. 26, contains gypsum.

CONCERNING SUPERINTENDENTS.

Written for the MINING AND SCIENTIFIC PRESS
By ALFRED ALLEN.

In two years I have swung around a loop of seven thousand miles, studying men, machinery, and mines. Some of the superintendents I have worked under were not only amusing, but instructive regarding danger points.

For instance; at one mine there was the Sneaky Superintendent. He would hide around the shaft-house at night, when the men were eating their midnight dinner, to see if they made any remarks about his lordship. They accommodated him, for they soon learned his methods by his carelessly repeating some stories they had told. Anyone who knows the A. B. C. of human nature knows the kind of work they would do for such an over-lord. He had taken a $10 course in a correspondence school and signed himself M.E. I once asked him what M.E. meant, and he said: "Mining Expert." This mine was in New England, and he was boasting continually of the big Western mines he had managed. One of the men had a brother in the West and wrote to make inquiries. Word came back from the mines that they had never heard of this "mining expert." His company was formed of wholesale druggists, probably as impressed by his M.E. as if it were an M.D.

Another I worked under was the Fussy Superintendent. Nothing was right unless done just his way. I've seen him order a machine-drill taken down after being set up by a driller who had mined for ten years. Then he would waste two hours setting it up his way. The rock above and below had to be faced off smoothly and no wedges used. Honest men refused to waste the company's time and were sent down the mountain. Only grafters were left who were willing to humor him and to sit around and visit while he fussed away, running the drill himself, or played with a pick at the face of the drift. Four hundred feet that he ran in soft shale cost the company $30 per foot.

One instance will show his usual method. A nut worked loose and fell off the top of the upright boiler he had placed 20 ft. in the tunnel. He called all the outside men to help search for it in the water and muck. They searched for an hour, shoveling out everything, giving the tunnel mouth a dentist's clean-up. But no nut could be found. A man suggested that there were nuts of the same size in the blacksmith shop. But no, that particular nut must be found. Another hour passed, but one of the men became so disgusted at such waste of time he slipped to the shop and secured a nut. Returning he stooped as if searching under the fire-box and cried, "Here it is!" It was put on. The superintendent said, "There! I told you we'd find it. See how well it fits." Those who had no conscience laughed.

Such second-childishness seems impossible in this day, but it is a fact. He held his position because he had promoted the property, and those who bought stock knew no better or didn't care.

In Alaska I met a type even worse than this. He might be called the Conceited Superintendent. That means ignorant, also. It was his first job over men, and his little head had swelled so he couldn't say "Good morning" to a workman. Anyone who has lived in the region of continual drizzle knows that men who are compelled to live in tents, sleeping in their wet clothes, trying to do a day's work for $2 and board, need something more than their monthly pittance and a drunk.

His face was like a pan of sour dough from which cookie has just withdrawn his fingers. He was honest as to dollars. Had he been really honest in a finer way, he would have resigned, for his dense ignorance cost the company many thousands. Everything was mismanaged, from the steep tramway built for horses, but up which they couldn't pull more than themselves, to the pipe connections that were put in without a single union. Everything went at sixes and sevens because he insisted on doing the thinking for every man on the job. He had a foreman who had thoroughly learned his business during thirty years. But he was so jealous of him he couldn't hear of his giving an order to the night shift without reversing it. He went into the drifts and told each one of the old miners where to put every hole. Of course, the honest ones put them where they would move most rock—after he had gone to bed. He nagged every man until only black looks and curses were the rule. One or two old gambling and smuggling cronies were his pets and could do no wrong.

For a dollar steel pin on the donkey a whole gang was held idle till the launch could make a 10-mile trip and bring a new one from town. When I respectfully suggested that we keep two pins on hand so we would lose no time and the millwrights not be kept waiting for timbers, I only won his enmity. Because I saved the cable one day, contrary to his orders, which would have wrecked it, I was punished by being put at the hardest job on the place, breaking rock to keep the crusher busy in the night shift, a task that, after I left, kept two men hustling. I was amused, for I should have known human nature better. He made the tone of the camp so bitter against himself that when every one saw a main shaft bending so that it must soon break, they said, "Oh let him see it. He knows everything, and is doing all the thinking on the job. He'll fire the man who dares tell him." They didn't try to save it. It broke the next day.

The big pipe that carried the water to the compressor became filled with tons of gravel and broke several times, costing hundreds and weeks of delay. He wouldn't put in a gravel trap at the penstock because a workman suggested it.

Why speak of the many things that wasted time and money? Just one little instance will show his whole unbusinesslike method. He would allow only one large monkey-wrench on the place because wrenches cost a few dollars. But one man was kept busy chasing from the face out to the blacksmith shop, from the shop down to the mill that was being built, from the mill to the compressor room, from compressor down the mile of tram to the donkey engine for that one big wrench. The time that that

nipper put in finding that wrench would buy a case of wrenches, but the superintendent, like all ignorant superintendents, did not reckon time as dollars. The man who hinted at another wrench was in disfavor at once. The only men he could keep for a second pay-day were Slavs or Dagoes who had so little manhood or pride in their work that they would submit meekly to any amount of bullying as long as their monthly check was sure. His being a superintendent was a joke throughout all that region. And he kept them laughing. He kept his place by toadying.

I was once telling these and other things about him to the famous owner of a mine I was visiting. He has worked up from a miner and superintendent to the making of a score of millions out of one mine. As I finished, he remarked, "I'll bet anything he was strong on dignity."

"Yes, very," I replied.

"I've always found," he said, "that dignity is a mantle assumed by ignorance to hide itself."

I met one man who was drawing $450 per month as superintendent. He never went near the mine, but kept a dipsomaniac brother on it as watchman. This case hardly comes under the head of superintendence, but frenzied family graft.

As contrasts to these types I met many who were an honor to manhood. I am glad to say they were the great majority. For instance, one man I met in Nevada. He had what is called 'tact' in women, but 'horse-sense' when a man possesses it. He took pains to know every man's first name. And he called him by it with a cheery "Good morning, Jack," or some other greeting, no matter how many times a day he passed him.

He made every man his personal friend who worked with a will. Of course it was only his work he really had an interest in, but the men put such a life into it that he was worth much more than his salary. It was a pleasure just to visit his place. He saw that his men were warm, had a drying-room, and decent places to sleep. He put in a reading and game room. The men felt they had a home and regretted leaving. All these things paid big dividends.

For instance, one little trick of his: Sometimes he would say, "Now, boys, the work's behind what we should do. I'm getting up against it. If you'll help me out so many feet by Saturday night, we'll have a chicken dinner." They would even work overtime to help him out, and the company profited many times the cost of those chickens.

Practical steps in the direction of winding by electricity have been taken at collieries in South Wales and at the mine of the Tarbrax Oil Co., Ltd., in Scotland. Experience tends to show that, compared with electricity, winding with the steam-engine is cheaper in installation and in working costs, and consequently that when a steam-raising plant is available the steam winding-engine is to be preferred.

Aluminum is now manufactured by electric methods at a number of works controlling over 84,000 horsepower.

ADAPTATION OF A STEAM-DRIVEN COMPRESSOR TO WATER-POWER.

Written for the MINING AND SCIENTIFIC PRESS
By HORACE G. NICHOLS.

The following notes on the adaptation of a steam-driven compressor to water-power may be interesting:

The compressor is an Ingersoll, type D, duplex-steam duplex-air, with a capacity rated at 7 drills. The conditions that favored the change were: The increased cost, due to a diminishing supply, of cordwood for making steam, and the fact that a site was obtainable 3000 ft. from the mill-building in which the compressor was originally installed, where all the water, available for power, passing through the plant, could be obtained again under a head of 315 ft. A flume and pipe-line were already in existence for the conveyance of the water to this lower site. The first intention was to install a water-motor and transmit power by a rope-drive to the compressor-shaft, but this plan was thrown out in favor of a water-wheel being substituted for the fly-wheel, and later of converting the fly-wheel itself into a motor, by attaching buckets. The new site is on a wash of loose sand, clay, and boulders, and pile-driving was out of the question. These facts were largely responsible for the aim to have the foundation as inherently compact and strong as possible.

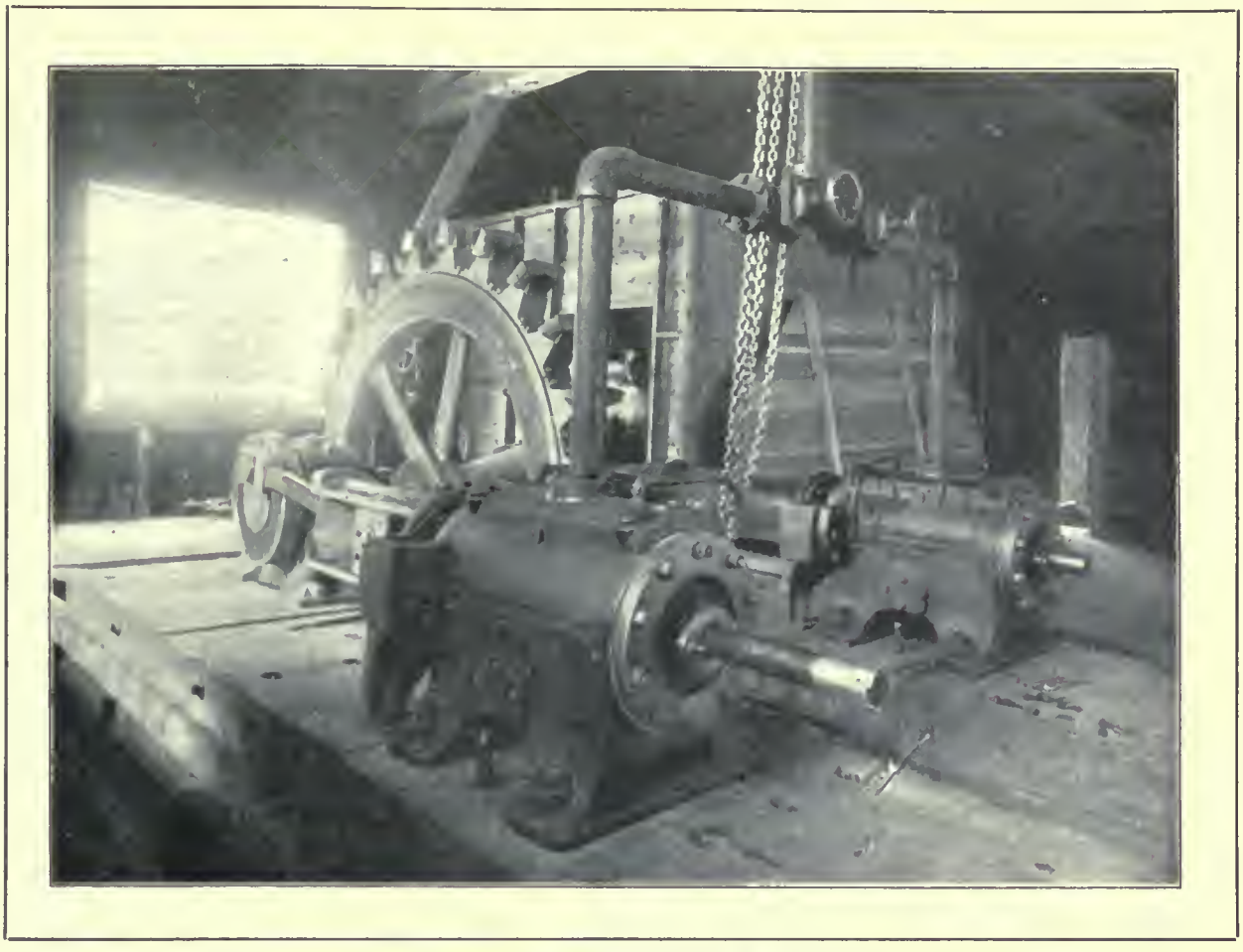
By taking out the steam cylinders, the floor space could be reduced to 15 by 12 ft. The ground was excavated for 8 ft. Boulders and rubble were tamped down for a thickness of 2 ft., and then a solid block of re-enforced concrete 28 in. thick was put down over the whole bottom. In this concrete were used 5000 lb. cement, 20 tons of freshly broken rock and fine gravel, and 22 12-lb. steel T rails laid cross-wise, the bottom row holding down the anchor bolts. The concrete was allowed to set three weeks before the solid timber foundations for the two sides of the compressor were built up. These timber foundations were each made of 16 pieces of 12 by 12 by 15-in. pine, keyed and bolted together with 1-in. bolts.

The steam cylinders were replaced by castings, shown in the photographs on the opposite page, by which the guide-frames were connected to the air-cylinders, allowing a space of 8 in. between them, and the air-cylinder piston-rod was connected to the cross-head by a short piece of 2½-in. rod just sufficient to bridge this space.

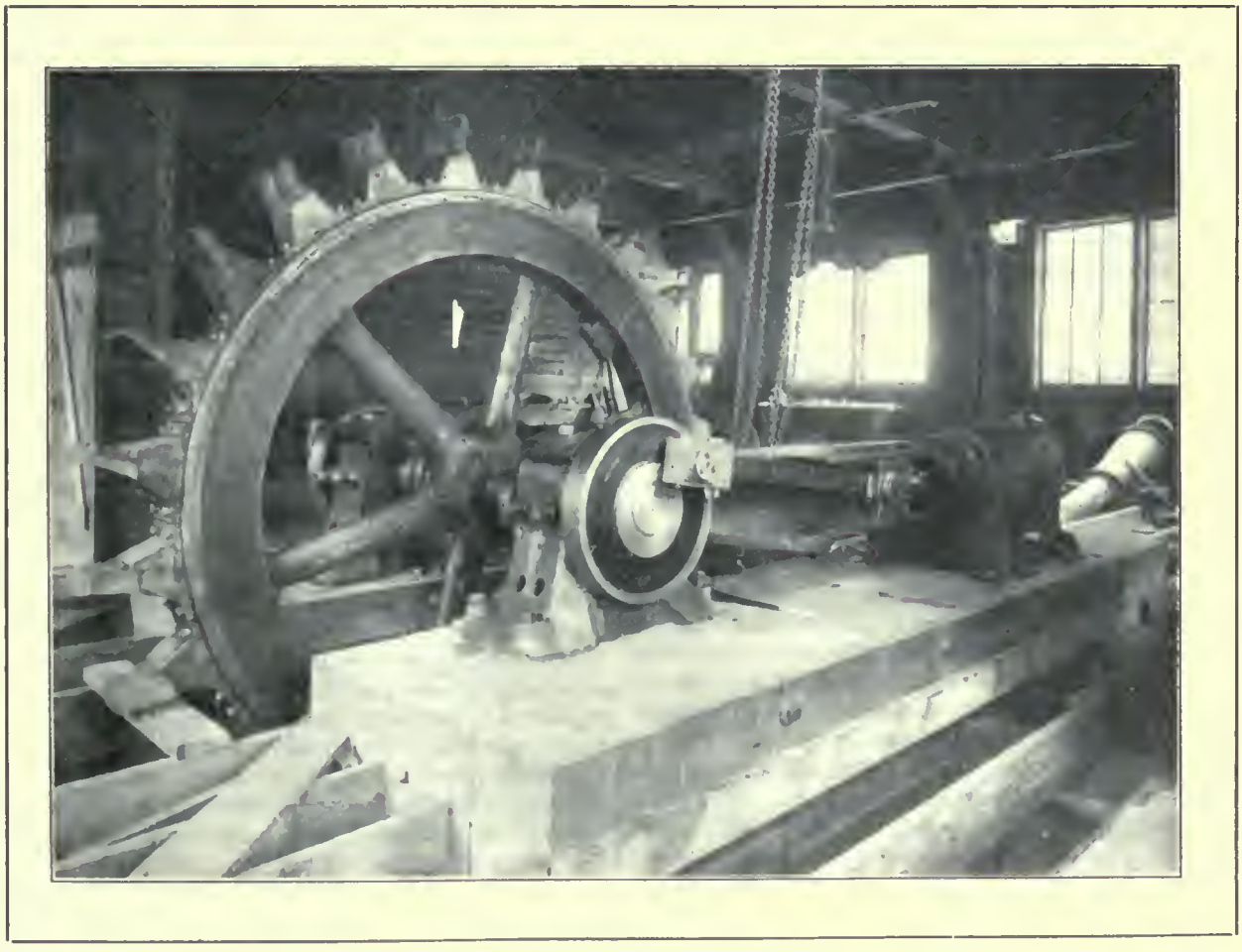
The fly-wheel diameter was 99 in. The diameter of a water-wheel required to satisfy the conditions of 315-ft. head and 120 rev. per min. being 124 in., the difference was made up by casting the buckets with webs or feet that interlocked in the manner shown, forming a continuous band round the fly-wheel, and the attachment was by means of four ⅝-in. cap-screws to each bucket. Each bucket weighed 39 pounds.

The compressor has now been running six months with perfect satisfaction. Efficiency trials have been made from which the following data have been collected: Head of water 315 ft., flow of water 290 cu. ft. per min.; horsepower of water, 147; revolutions per min., 123; M. E. P., 35.87 lb.; piston area, 152.88 sq. in.; stroke, 1.5 ft.; I. H. P., 122.65; efficiency, 83%. Every care was taken in making these trials and there is no doubt that one or two points were lost owing to the somewhat worn condition of the cylinders.

Tellurium and Gold.—It is now a matter of common knowledge that the volatilization loss in the roasting of telluride ores is not heavy. In every careful experiment the amount of gold sublimed has been found to be practically nothing.—T. K. ROSE.



Steam-Compressor Adapted for Use With Water-Power.



A Fly-Wheel Transformed Into a Water-Wheel.

MILLING IN THE COEUR D'ALENE.

Written for the MINING AND SCIENTIFIC PRESS
By GEORGE HUSTON.

The type of mill used in this district takes into consideration only one property of the ore treated, that of specific gravity. The softness of the commercial metal is a factor entirely neglected, and to this property is due most of the loss incurred in concentration. Not all of the so-called slime is due to the mill machinery; a good portion is already reduced to a slime before reaching the mill.

The veins are large. Overhead stoping is the rule, machine-drills, long holes and heavy charges, deep chutes, and rough handling between the mine and the mill are the usual methods; no wonder so much fine stuff is made. The mining methods may be unavoidable, but the subsequent mill treatment shows that the factor of abrasion and the treatment of the fine resulting from rough handling, were completely overlooked in designing the head end of the ore-dressing plants. Hand-sorting obtains in some cases. The ore arrives at the mill in sizes ranging from lumps 12 inches in diameter to impalpable galena dust, the latter due to the tremendous force of explosives on the soft sulphide of lead. Assuming that the handling in transit is unavoidable, we find on examination under a strong magnifier that the damp ore is coated with fine galena particles; in the lines of fracture the galena stands out boldly in sharp points on the harder material; abrasion has resulted in the creation of fine, from the pounding and friction of hard against soft material and the action of explosives. The harder portions have stood the ordeal comparatively unaffected, so that the fine is really the richest portion. At this juncture comes the crucial point in the milling of the Cœur d'Alene ore.

The prevailing practice is to pass the ore dry over grizzlies into the coarse-crushing machinery. From the bin it goes through the rolls and under the rolls receives its first dilution of water which is intensified by the meeting of the water carrying the middling from the coarse jigs, in process of elevation to the trommels. Further dilution occurs in the wash-water of the trommels. From this point the fine material with its water dilution is passed to the classifiers, or is led over a traveling belt-screen on the way to the concentrating machines. Abrasion has been intensified all the way through. The initial error consists in allowing this material to go through the abrasive action of the mill machinery, and subjecting it to the very large water dilution. This results in compelling a large installation of equipment, necessary to separate and treat a highly diluted product at the other end of the mill.

Good practice with soft ore indicates that no part of the product should be handled any more than necessary from the mill-head to the shipping-bin, in order to save abrasions and dilution. The part already sufficiently reduced in size should go direct to the concentrators. As for dilution, this should be kept at a minimum. The feed should be washed with water under high pressure through a small orifice to reduce this feature. The high pressure and small orifice should exercise a cutting action on the lumps and particles, just furnishing enough water to wash the material to the settler or belt-screen. The avoidance of abrasive apparatus in the mill equipment should be carefully studied and means provided below to remove the fine without allowing dilution to a greater extent than necessary.

Dilution compels installation of low-capacity machines such as the vanner and slime table, the handling over and over of the water and the large settling capacity so costly and such a prolific source of bother. Large slime losses are due to the error in trying to separate the fine at the wrong end of the plant. An ounce of prevention is worth a pound of cure.

Reverting to abrasion, I omit the trommel, a machine ruled out in good practice in Australia and Europe in favor of the shaking screen, and come to the jig treatment. Roughing or bull jigs are in use in every mill, regardless of the dissemination of metallics in the feed. In a finely disseminated feed, the bull jig is clearly out of place, as the coarse tailing still contains a considerable percentage of ore, which should be first re-ground. As an abrasive machine it is a bad example. A sample of mill-feed metallics taken from the bin before treatment, shows sharpness of angle and outline. The surface is rough. Samples taken from the cups of the bull jig, show the lumps, rounded and smooth. In an inspection of five cars of coarse concentrate at one of the large mines, all the lumps examined over 5 mm. in size showed the same rounded outline and smooth finish, indicating large losses. In three instances in the district the jig-water is caught and settled; in the majority of cases it washed into the tail-race.

A cure for this brings us back to the principle that there should be no unnecessary abrasion in handling and this would indicate that greater emphasis should be given to specific gravity on the jig-bed. The concentrate should be taken through the screen. In order to do this the screen-sieve should be of a larger perforation, and suction on the jig should be reduced or abolished in order to lessen the carrying down of waste particles into the clean concentrate. Suction on a coarse jig is out of place. It momentarily stops and starts the passage of the waste material. The specific gravity of coarse material is sufficient to settle the galena without the help of the back stroke of the plunger. Reducing the suction is accomplished by putting valve openings in the plunger. It is not within the limit of this article to treat further on abrasive action.

In a district treating approximately 5000 tons of ore per day, it is lamentable that no organized attempt has been made to bring out good practice for the common good through co-operation. Not a testing plant exists and defective sampling is responsible for the ignorance prevailing on what is really being done. It is hoped that the present article will stimulate discussion.

DRYING AIR FOR BLAST-FURNACES.—F. W. Harbord, a leading authority in England on iron and steel, describes in British patent No. 25112 of 1906 an interesting method of drying the air used in blast-furnaces. He uses a salt which takes up water of crystallization without deliquescing and which subsequently gives up its water at a comparatively low temperature. For this purpose he finds the sulphates of zinc, copper, or magnesium the most suitable. It has before now been proposed to use chlorides of calcium, magnesium, or other metals, but these more or less deliquesce and also tend to decompose on repeated dehydrations. In preparing the drying apparatus, porous material, such as common brick, is immersed in saturated solutions of the sulphate and so impregnated with the hydrated salt. The bricks are then built up into the drying chamber, and subjected to heating by means of hot air or some inert gas. The water of crystallization is thus driven off and the bricks are then ready for dealing with the blast as it comes from the blowing engine. In practice, the drying chambers will be arranged in pairs so that one is drying the blast while the other is having its water of crystallization removed by the hot air, and the pair of chambers will be fitted with suitable reversing valves.

MINING IN NEW ZEALAND.

Written for the MINING AND SCIENTIFIC PRESS
By an Occasional Contributor.

At Whangaroa, in North Auckland, there are copper-bearing lodes. An effort is now being made to work these, but the recent fall in the price of copper has had a discouraging effect. Whangarei is the principal centre of population in the North Auckland district. It is marked on the map on account of the Hikurangi, Komo, and Ngunguru coal-mines, which are in the adjoining district.

On the Hauraki peninsula, Coromandel is at present at a low ebb. A geological bulletin, by Fraser and Adams, is now in the press and will soon be available. At the Thames the rich patch in the Waiotahi mine, discovered about the end of 1904, is now nearly exhausted. For some time this yielded bullion at the rate of £18,000 to £19,000 per month, but the monthly output is now reduced to about £9,000, and will probably soon be much less. No other Thames mine is doing much in the way of gold getting.

At Karangahake, the Talisman mine is doing very well, the monthly output being about £15,000 to £16,000. The ore averages £1 per ton. The Crown is hardly paying its way, with a monthly output of £4,000 to £5,000, the ore averaging about £2 per ton. The Waihi mine is maintaining a monthly output of £60,000 to £65,000. The September yield will bring the total return to over £6,000,000. Its neighbor, the Grand Junction, has a monthly output of £4,500 to £5,000 from 10 stamps, but has not yet reached the dividend stage.

In the Te Aroha district very little mining is going on and at present there is hardly any gold production. Near Gisborne there are indications of oil, and some prospecting has been lately done. Some of the people there are pressing for a geological survey of the oil-bearing country. They want the anticlines mapped.

At New Plymouth there has been considerable excitement within the last year owing to a good flow of oil having been struck in one of the bores at Moturoa (two miles away). A few barrels of crude oil have been sold, but at present the bore is sealed. New Plymouth may be regarded also as the centre of the future 'iron sand' industry of New Zealand.

In the neighborhood of Woodville the Maharahara Copper Co. is reported to be developing a large copper-bearing lode, but lately we have not heard much about this property. The Mokau river, north of New Plymouth, gives access to a large coal-bearing area. At present one mine is operating. The principal coal-bearing district of the North Island, the Waikato, about 40 to 50 miles south of Auckland has not been marked on the map. The chief townships here are Huntly and Taupiri.

Picton is near an alluvial gold-mining district, Wakamarina, which is now no longer prominent. Antimony ore has been worked at Endeavour inlet, a bay off Queen Charlotte sound. South of Nelson is a copper-bearing district, where the United Copper Co. is now operating. They have shipped a few tons of ore to Sydney. Collingwood is the port of a well known mineral district. Undoubtedly the chief mineral resource of this place is the Parapara iron ore (see N. Z. Geol. Bull. No. 3 lately published). A company to work the iron deposits with a capital of £600,000 has just been underwritten at London. The ore is there in almost unlimited quantities, and the quality is good. Most of the conditions required for success are present, but it remains to be seen whether at the present time it is possible to compete with British manufacturers for the Australian trade, on which success must depend; for I think the population of New Zealand is as yet too small to keep a really big iron concern going, even though the Parapara Iron Co. should succeed in obtaining all the New Zealand orders by means of a heavy protective duty, which it will no doubt promptly demand.

Westport is the principal outlet of New Zealand's finest coalfield. Greymouth is also a coal-exporting port, as well as the centre of an alluvial gold mining district. It is a flourishing town. Reefton is the centre of an extensive vein-quartz district. The principal mines are under the control of the Consolidated Goldfields Co., an English concern. The gold output of £10,000 to £12,000 per month is at present inclined to decrease, but the English company is developing a new mine, the Blackwater, which is expected to turn out well. Hokitika is now almost completely shorn of its ancient glory, and is supported more by timber and agriculture than by alluvial gold mining. Present population about 2,000. Ross is in a similar state of decadence. One alluvial claim, the Mont d'Or, is still yielding well.

Kaitangata is marked on the map as the chief coal-mining centre in Otago. Orepuki has coal in its neighborhood, as well as alluvial gold (and a little platinum).

Dredging has had a great vogue in New Zealand, but its day seems to be passing. The amount of ordinary alluvial mining is slowly decreasing, and gold-vein mining is even deader than it was ten years ago.

THE production of Nevada in 1907 is estimated at $15,000,000 of gold and 6,000,000 oz. silver.

THE BOSTON CONSOLIDATED MILL.

STAFF CORRESPONDENCE.

The new mill of the Boston Con. M. Co., situated at Garfield, 15 miles west of Salt Lake City, is practically complete, with three of its 13 sections in operation. The main building, crude-ore bins, and machine-shop are built of structural steel and the transformer building is of brick and concrete. The machine-shop is modern as to arrangement and equipment and is prepared to manufacture ore-cars and to cast shoes and dies, as well as do all kinds of repairing that this company may require. The ore-bins occupy a building 300 ft. long and have a capacity of 15,000 tons of ore. The mill-building is erected on concrete foundations, lying upon the northerly slope of the Oquirrh range, facing the lake, the surface inclination being such as to favor the arrangement of the machinery for automatic work.

The machinery installation is in 13 sections, each of which contains 24 Nissen stamps, 4 classifiers, 24 Callow cone-settlers, 18 Johnson vanners, with an interesting system of launders and distributers for conveying the classified material in accordance with a well-designed plan. By tracing the material from the ore-bins to the final re-treatment process, it will be seen that there are no elevators in the mill, and that the movement of the ore through the various stages of the process is by force of gravity, with the exception of a belt-conveyor, operating at a 20° incline, which conveys the ore from the crusher floor to another conveyor that distributes to the battery-bins.

The ore is delivered to the crude-ore bins from self-dumping railroad-cars. From the bins the ore is fed through ratchet link-belt gates to heavy belt-conveyors, which deliver it to two (style K) gyratory crushers, and these reduce it to a 4-in. ring. It passes thence to revolving screens of manganese steel, having 1¼-in. opening. The material passing through these screens is ready for the stamps, but the oversize is re-crushed to 1¼ in. by two (style K) short-head crushers. The ore, after being reduced to this size, is delivered to the incline belt-conveyor, above referred to, which discharges upon a second conveyor, the latter being equipped with a 'tripper' by which the ore is distributed to the various bins above the stamps. From the bins the ore is drawn automatically into Challenge feeders, of which there is one feeder for each of the 312 stamps. These stamps, weighing 1500 lb. each, crush the ore through 28-mesh screens of No. 28 wire cloth. Each stamp drops into an independent mortar and is estimated to perform a duty of between 9 and 10 tons per day. The pulp from the mortars passes to a system of hydraulic classifiers, the overflow from which passes to Callow cone-settlers, which make four sizes, each size discharging upon a Wilfley table. The first product of the classifiers, of each section, is fed to six Wilfley tables, which make a concentrate, middling, and tailing, the headwaters being re-treated over Johnson vanners. The second product of the classifiers is treated like the first, and the third size of each section is handled by six Wilfleys which produce a concentrate and middling, but no finished tailing, the middling being re-treated over the vanners. The slime-settling syphoned from the Callow tanks is concentrated by four Wilfley tables for each section, and all this material except the concentrate is re-settled and re-concentrated over vanners.

All the concentrate produced passes to one launder for each section and all these converge into one main launder, which conveys the concentrate several hundred feet into five re-enforced concrete bins, where it is settled, the water drawn off, and the concentrate loaded into cars by a clam-shell bucket, manipulated by a locomotive crane. The final tailing is conveyed to a waste basin on the desert by means of a main launder that receives the tailing from all sections of the mill. All overflow water from the Callow settlers is pumped to the reservoir above the mill for use again. The water for the mill is conveyed by a pipe-line from springs eight miles away to a pump-station in the valley near the mill, where two turbine electric pumps lift the water 380 ft. to the reservoir above the mill.

The concentrate is a clean product, representing a reduction of 15 to 20 tons to one ton, from an ore carrying 1.4 to 2% copper and $2 to $3 in gold and silver per ton. This ore, mined at the Boston Con. properties in Bingham canyon, is said to be uniform as to assay-value and occurs in a porphyritic gangue, having chalcopyrite, bornite, and chalcocite finely disseminated through it. A. J. Bettles, mill manager, who designed and supervised the construction of the mill, states that the machinery is giving most satisfactory service, and that the plant is making a higher extraction than he had estimated. All machinery is operated by electric power transmitted from the power-plants at Ogden and Provo. The transformer plant at the mill has facilities for receiving currents at 80,000 volts and reducing to 400 volts. The electric apparatus at the mill sub-station and in the mill are of the Westinghouse type.

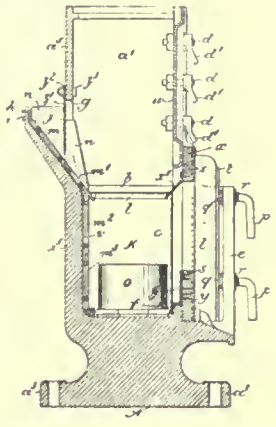
It may be further stated, to make the description complete, that the battery posts are of wood and the mortar blocks are of concrete deeply set. The stamps are installed in two parallel rows, 30 ft. apart, back to back, the chutes from the ore-bins leading to the stamps on both sides. While only three sections are now operating, it is stated that the others are nearly ready for work and will gradually be brought into service.

Earthquake shocks which have caused the shutting down of the Glendon mines, owned by the Wharton Steel Co. at Hibernia, N. J., are believed to indicate that the entire mountain range in which the mines are situated, extending through Morris county from northwest to southeast, is undergoing a settling process. The shocks have caused the cracking of the rock formation in the mine and caused the blocking of the adit leading to the workings, forcing the stoppage of operations. The shocks, it is said, have been felt at intervals for almost twenty years.

MINING AND METALLURGICAL PATENTS.

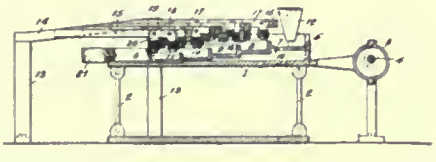
Specially Reported for the MINING AND SCIENTIFIC PRESS.

MORTAR-BOX FOR STAMP-MILLS.—No. 877,291; David A. Bremner, London, England.



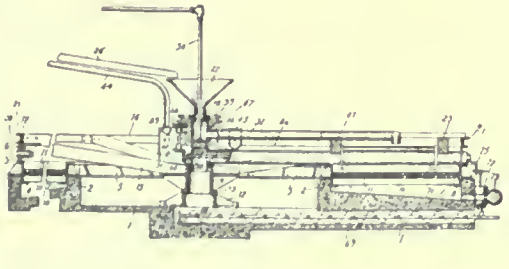
In a stamp-mill having a series of stamps, a mortar-box with a screen opening at the front and solid ends comprising front portions the internal surfaces of which are perpendicular to the back wall and intermediate portions having concave internal surfaces curved to a radius approximately equal to the distance between the center of the adjacent end stamp and the back wall of the box, said curved and perpendicular surfaces being adapted to guide the pulp round the end stamps and toward the front of the box, as set forth.

MAGNETIC SEPARATOR.—No. 871,301; Alfred Schwarz, New York, New York.



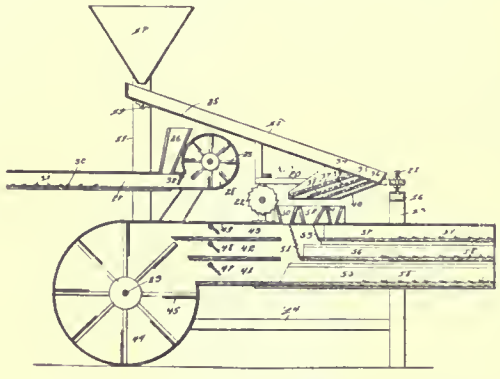
In a magnetic separator the combination of a table subdivided by riffles adapted to prevent transverse gravital flow of the material fed thereto, electro-magnets above and having their polar faces in proximity to said table, said magnets being disposed in independent rows, means to feed the material to be separated in proximity to the first row of magnets, means to energize and deënergize said rows of magnets successively to separate a given mass of magnetic particles from the nonmagnetic and to transport the former from riffle to riffle in response to magnetic attraction, and means to receive the separated masses.

CONTINUOUS FILTER FOR CYANIDING, AND THE LIKE.—No. 877,197; Bertram Hunt, San Francisco, California.



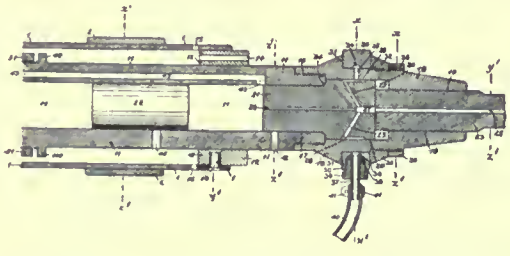
A filter comprising a stationary filter bed, a feeder movable over said bed for distributing thereover the material to be filtered, a scraper also movable over said bed for removing the residual material, and means for moving said feeder and scraper over said bed, substantially as described.

ORE-SEPARATOR.—No. 877,411; Aaron Custer, Monroe, Iowa; John Custer administrator of said Aaron Custer, deceased.



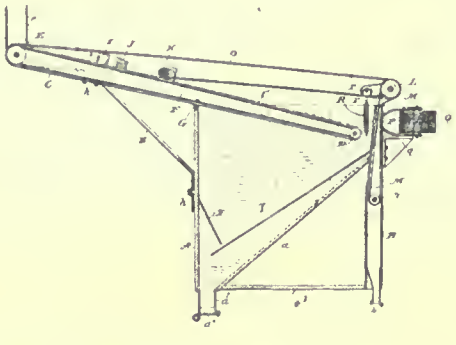
In an ore-separator, a suitable frame, a plurality of flumes horizontally mounted on said frame, screens extending down in the upper flumes, blast mechanism communicating with said flumes, feeding mechanism communicating with said flumes, and jigging mechanism acting on said feeding mechanism.

ROCK-DRILLING MACHINE OR ENGINE.—No. 872,417; Henry Hellman and Lewis C. Bayles, Johannesburg, Transvaal.



In a drilling or boring machine or engine actuated by fluid pressure, in combination, a casing, a hollow or tubular piece slidingly and non-rotatably carried by said casing, a head or tool-holding device revolubly attached to the forward end of said tubular piece inside the casing, a drill or tool operatively carried therein, packing located in the casing between the exterior of said tubular piece and the interior of the casing, means for introducing the actuating fluid to the casing at the rear of said packing to feed the drill, a piston in the tubular piece, means operated by the piston for transmitting to the revoluble piece and drill or bit an intermittent rotary motion in one direction, and means for admitting the fluid to reciprocate said piston.

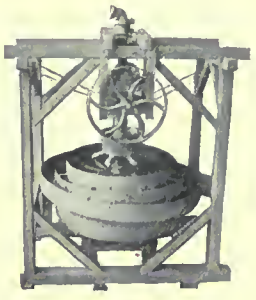
APPARATUS FOR MAGNETICALLY CONCENTRATING ORES.—No. 877,439; Henry Leighton, Seattle, Washington.



In a magnetic separator for treating materials in a wet state, a receptacle adapted to contain water, a magnet, means for feeding the material into the water into the magnetic field, and means interposed between the end of the feeder and the magnet in the direct path of the material for agitating the water between the discharge end of the feed and the magnet.

The Schutz Separator.

This machine is constructed with a view to concentrating the valuable minerals from mill-pulp, river gravel, or beach-sand, utilizing the principle of hydraulic classification with a number of important innovations. In the classifiers now generally used the water intended to force the lighter particles upward is introduced through a fixed aperture,

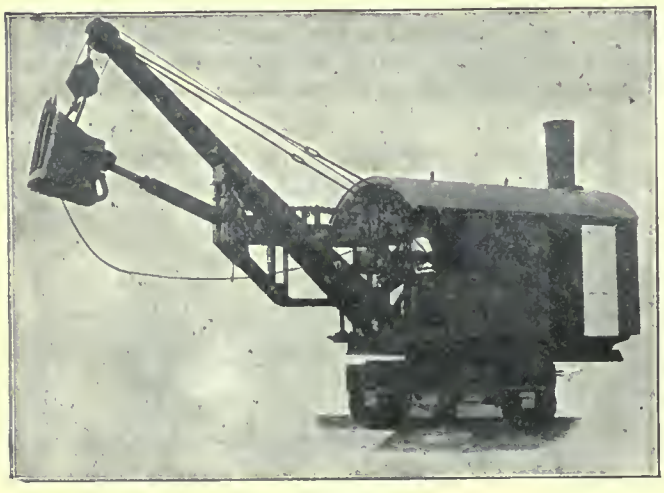


and from experience it has been found that the upward force of the water is not effective over the entire area of the hopper into which the pulp is passing. Mr. Schutz has overcome this defect by introducing the water through perforated pipes revolving on the bottom of a cylindrical hopper.

The hopper is fitted with two sets of submerged revolving metal brushes through which the pulp must pass. The brushes have the effect of cleaning and separating the particles. The hopper is constructed with an inner and outer shell, the space between the two shells forming the means of exit for the tailing. The machine is capable of large capacity. A 6-ft. machine with power attached is on exhibition at 471 McAllister St., San Francisco, and the Schutz Separator Co., owner of the patents, is prepared to treat samples of 50 to 100 lb. on a working model set up at the above address.

Thew Shovel for Electrical Operation.

It is frequently desirable to make use of power-shovels under conditions that preclude the use of steam. Where fuel or water are not available or for operation in tunnels, underground mines, or confined spaces, it is at times possible to substitute electrical power. For such requirements the engines and boilers of the standard machines are



replaced by electrical motors of suitable design. Any one of the varied forms of current in commercial use can be adapted to service of this nature and we are prepared to equip any of our single-truck shovels for electrical operation. For such installations, the motors are of the most approved type, of ample power and especially adapted to the requirements, which are both peculiar and severe. The current is preferably received through contact rings on the truck-frame, to which are connected flexible cables from the feed-line. The current is transmitted through carbon brushes, suitably attached to the turntable or revolving portion of the shovel. The wiring, switches, circuit breakers, controllers, and all necessary adjuncts conform to the most approved methods. Experience has shown the most desirable equipment for direct-current installation to comprise two motors, the swinging motion being controlled by frictions from the hoisting motor. Where alternating current is employed a single motor operating at constant speed is recommended, all motions being controlled through friction clutches. The absence of the boiler and water-tank necessitates the use of a counterweight to secure proper stability for the machine. The fireman, usually required for rated capacities, is not needed where the electrical design is employed and the shovel becomes a strictly one-man machine. Further information can be obtained from the Thew Automatic Shovel Co., of Lorain, Ohio.

Books Received.

'Mining Investments and How to Judge Them' and 'The Investor's Primer' are two new books likely to be in demand at this time, when the whole question of investment is so much in the minds of people. These books are by John Moody. The first is an attractive handbook covering, in an entertaining manner, the whole subject of mining investments and the values of stocks The author is said to be a man of wide experience The second volume discusses the general question of investment, it gives in a clear and concise manner the definitions of important terms and phrases used in the banking and investment business, and a description of the methods involved. Each book sells for $1.50 and is obtainable through the MINING AND SCIENTIFIC PRESS.

'The California Earthquake of 1906.' Edited by David Starr Jordan. Published by A. M. Robertson, San Francisco. 360 pages. Price $3.50. This attractive volume includes two papers by the President of Stanford University and by G. K. Gilbert, reprinted from *Popular Science Monthly;* it contains a new essay by Charles Derleth, of the University of California, besides three other papers, and finally a sketch of personal experiences by Mary Austin. The book is well illustrated and well printed. Within convenient limits it affords information concerning the various features of the earthquake, from the geological to the structural, and from the purely scientific to the intensely human aspects of the disaster that overwhelmed San Francisco and the neighboring towns. We have had a good deal of earthquake literature and this represents some of the best of it.

SCHOOL OF MINES OF THE PENNSYLVANIA STATE COLLEGE.—The last legislature of Pennsylvania appropriated $50,000 for this School, of which sum $20,000 was for further extension of its buildings and $30,000 for maintenance. The buildings, as planned and partly built and occupied, contain over 60,000 sq. ft. of floor space. The buildings contain laboratories and lecture-rooms, for the instruction in crystallography, mineralogy, petrography, geology, mining geology, metallography, metallurgy, assaying, ore dressing, coal washing, mining, etc. Among the recent appointments are these: Clarence P. Linville, Assistant Professor of Metallurgy; Frank A. Dalburg, Instructor in Mining and Metallurgy; Lloyd B. Smith, Instructor in Mineralogy and Geology; and Howard I. Smith, Instructor in Mineralogy and Metallurgy. The summer school in Surveying and Mining was conducted at Canonsburg, Pa., in the mines of the Buffalo & Pittsburgh Coal Co., under the direction of Messrs. Dalburg and Smith. Later a large party of students spent the remainder of the summer at the mines of the Nippising Co., at Cobalt, Ontario. The class graduating from the School, in 1907, numbered 26 men.

THE A. S. CAMERON STEAM PUMP WORKS of New York now has ready for distribution its catalogue No. 35. It is probably one of the most complete pump catalogues ever published and contains much useful information for pumpmen and engineers.

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Editorial.

IN ORDER TO prevent any misunderstanding of the attitude assumed by the officers of the Geological Survey in relation to the proposed Mining Bureau, our readers are invited to read the letter of the Director, Mr. George Otis Smith, appearing on another page of this issue.

NEW IDEAS on the theory of ore deposition are always interesting, especially when they are offered by experienced geologists. Our readers will be glad to study the contribution from Mr. J. E. Spurr appearing in this issue. Mr. Spurr is the author of 'Geology Applied to Mining,' a handbook much in demand among those who are engaged in mining whether as operators or engineers, and by his experience, first as an officer of the Survey and then as a specialist employed by the Guggenheims, he is particularly fitted to throw light on the dark places of ore deposition.

REFERRING TO the State Mining Bureau, the administration of which we criticized in these columns recently, we note that the executive committee of the California Miners' Association at its last meeting unanimously passed a resolution as follows:

"Resolved, by the executive committee of the California Miners' Association that said committee has learned with extreme regret and deep indignation that Mr. Chas. G. Yale has been removed from his position as Statistician in the State Mining Bureau:

"That in the opinion of said committee no other man in the State can so efficiently fill said position as said Charles G. Yale, and that his removal is a detriment to the usefulness of the California State Mining Bureau, and to the mining interests of California, and we hereby desire to voice our emphatic protest against this action.

"Resolved, that a copy of these resolutions be certified by the secretary of this committee and be sent to the Governor of the State, to the State Mineralogist, and to each member of the Board of Trustees of the California State Mining Bureau."

The persons to be held responsible are the Trustees. They can refuse to confirm the new appointment of Mr. Yale's successor. We look to them to act in the public interest.

AMONG THE OPPORTUNITIES of becoming rich quickly is that offered by the Nome Gold Dredging and Power Company, concerning which some astonishing things are said in circulars now being sent broadcast. "This proposition will pay dividends of 100 per cent per annum," it is "one of

the most profitable enterprises known to mankind," and it has gold "sufficient to pay an average of 100 per cent annually for over 44 years to every stockholder." Among the officers of this benevolent enterprise is the "Hon. William J. Stone, Jefferson City, Missouri, United States Senator from Missouri, and former Governor of that State." Is he so poor as to have to sell his name for boosting a scheme concerning the merits of which he is no judge, a scheme that on the face of it is a rank imposture, or is he simply dis-honorable? It is time for public men to know that they can be held to account for lending their names to irresponsible promoters, for exchanging what they possess of honor for a block of stock, for using public office as a lure to the unwary.

DIVIDENDS paid by companies operating the gold mines of the Transvaal amounted to £7,131,608 or $34,588,298 for the year 1907. Forty-five companies out of 65 productive mines contributed to this total, the increase over 1906 being £1,396,443. It is estimated the profits earned by the mines of the Rand in 1907 was £10,000,000, or nearly $50,000,000, on a gross production of £27,403,728.

Rawhide, Nevada.

RAWHIDE is the scene of the latest mining excitement in Nevada. This new camp is in Esmeralda county, about 25 miles east of the upper end of Walker lake, 45 miles by stage from Luning, 54 miles by automobile from Mina, 30 miles by automobile and stage from Schurz, and about 50 miles south of Fallon. At the present moment there is a tremendous rush of gold-seekers toward this new El Dorado, and it is likely that the general stagnation of other forms of business enterprise will stimulate an unprecedented boom even in a region that has seen so many episodes of the same kind. We learn from Mr. Algernon Del Mar, who is our representative at Rawhide, that the ore is a quartz-porphyry containing free gold in association with pyrite; the veins are wide and the general character of the formation resembles that of Camp Rochester, near Ludlow, in San Bernardino county, California. Some of the ore is undoubtedly rich, but the evidence available at this early date indicates that the future of Rawhide will depend on the ore milled on the spot, that is, not much of it is rich enough to be shipped to the smelters. This means that systematic work will be necessary, capital must be invested under proper advice, and the productive character of the district will not be made apparent right off. The times change, and we with them; nowadays a mining boom springs into life full-fledged, with tail feathers and a triumphant shriek enough to awake the seven sleepers of fable. Distance is vanquished by automobiles, the telegraph is the herald of mineral discovery, newspapers and saloons are at work almost with the first blow of the pick, and the real estate speculator follows hard on the heels of the prospector. Let us be hopeful that this new scene of mining activity will be another of the successes scored by Nevada during recent years, but let us remember that gold mines are not made by much shouting. In the meanwhile, if you have spare time and a few dollars that you can afford to lose, go and see Rawhide for yourself.

By-Laws of the Institution.

NOTICE has been given of a special meeting of the members of the Institution of Mining and Metallurgy, to be held at London on March 18, for the purpose of voting upon some changes in the by-laws. We note with interest that besides the old regulations (as to a candidate for membership being 30 years of age, occupied in practical mining or metallurgical work, and for at least five years in a responsible position thereto), it is now provided that the candidate may gain election if in the opinion of the Council he is a desirable person to become a member, by reason of his position or attainments. This amendment was undoubtedly proposed with an eye to the dilemma created by the fact that in times past one or two engineers not yet 30 years old and yet occupying positions of great responsibility have been ineligible for membership although ranking high in the profession. For instance, it is not invidious to say that both Messrs. H. C. Hoover and A. C. Beatty were doing important work and carrying heavy responsibilities successfully before they were 30 years old. Capacity for work is not measured in terms of the calendar. Next we note that candidates for admission as associates of the Institution must be 25 years old and shall have been engaged in practical work for a period of **two** years if graduates from a recognized School of Mines; if not so graduated, then **four** years is the time specified. This is a significant and logical recognition of the particular value of a special training, namely, it facilitates the attainment of practical knowledge. Many men who never went to a School of Mines have proved themselves among the best engineers in the world, and some men who graduated with scholastic honors have been failures in the wider arena of life, but it is certain that as a rule the special technical training enables a young man to learn more quickly and more systematically—that is the demonstrated theory underlying the whole idea of technical education. The Council recognizes it. Finally, it is proposed to increase the dues from all classes of members. Full members elected after December 31, 1908, will pay three guineas or $15, instead of two guineas or $10. This is an important departure and we applaud the courage of the Council in choosing this method of increasing the income of the Institution. Within the last three or four years it has become apparent to the officers of the Institution at London and to those of the Institute at New York, that the expenses of publishing the transactions, in pamphlet and volume, together with the growing cost of administration, were gaining upon the revenue. To both societies there came the temptation to sell advertising space in their bulletins; the Institute yielded to the temptation; the Institution set it aside as bad form. The alternative was to increase the dues; the Institute deemed it

inadvisable; the Institution has adopted the plan, which will now go into effect. We hope, and believe, that this method of raising the necessary funds will be a success. If it is, then our Institute in New York will have an excellent object lesson, for if higher dues prove acceptable in England they ought to be so in America, where the cost of living is so much higher as to make $15 seem a good deal less than £3. On the whole, these changes in the by-laws will tend further to establish the claims of the Institution upon the confidence of the English-speaking members of the mining profession.

Copper Production.

THE LARGE SURPLUS of copper, estimated at 200,000,000 pounds in October, has been cut down to less than 70,000,000 pounds and there is said to be a healthy demand for the metal in Europe. Mr. James Douglas states that "the consumers are anticipating an advance in price in the near future," but other reports suggest unusual apathy on the part of American consumers, despite the diminution in the stock of metal. Undoubtedly, the copper market is sensitive to the threat of the forthcoming commencement of production on a large scale from two or three mines in Nevada and Utah. The Utah Copper Company at Bingham is now producing at the rate of 3,500,000 pounds per month, the yield being 1¼ per cent. It is estimated that the concentrators of this company will, within a few months, be turning out 55 to 60 million pounds of copper per annum at a cost of 8 cents per pound, delivered at New York. The Boston Consolidated, in the same district of Utah, has made a good start and is ready to produce about 35 million pounds per annum at a cost of 9 cents per pound of copper. Finally, the Nevada Consolidated and Cumberland & Ely mines will soon be sending their ore to the new Steptoe plant and after May next the output is expected to be 35 to 40 million pounds of copper, from ore averaging 2¼ per cent. Eventually the Steptoe concentrator and smelter are to have a capacity of 60 million pounds per annum and all this copper will be delivered on the New York market for a total cost of 8 cents per pound. Moreover, the Cerro de Pasco mine, controlled by James B. Haggin and the Hearst estate, is beginning to produce copper, after 10 years of preparatory work. In 1907 this property yielded 20,152,000 pounds of copper, all of which was refined at Baltimore. In 1908 the production is to be 30 million pounds, and it is predicted that a maximum of 50 or even 75 million pounds is likely. Up to the present no less than $17,500,000 has been spent in equipment and development. Finally, the ore deposits of the Tanganyika Concessions Ltd., in central Africa, are destined to influence the copper market as soon as the railroad, now under construction, is completed and reduction works are built. This source of copper is yet in reserve, but it is likely to influence the market four or five years hence; so also are the new districts of the Copper River, in Alaska. No wonder the operators of copper mines, no less than the metal brokers, are in a state of anxiety, for all this cheap copper makes it so much harder for the old mines to win a profit, because the prolific production of these new enterprises will tax the capacity of the market.

In copper mining, as in the cosmos, it has become a struggle to survive and the fittest to survive is the mine that operates under the largest margin of profit. Of the older mines, the Calumet & Hecla with an 8½ cent cost, or the Osceola with 10½ cents, is in a strong position, but the Anaconda, which produces copper for 11.8 cents per pound has now a small margin, and the Greene-Cananea with an actual cost of 15 cents and a hoped-for reduction to 12½ cents, is in a decidedly weak position, as long as copper hovers around 13 and 14 cents. The special report of the Census Bureau gives some interesting figures in regard to the cost of copper in 1905; for instance, the gross cost in Michigan is given as 11.4 cents for refined copper, and in Montana 11.6, after the gold and silver are deducted. In Utah blister copper cost 15.5, or 5.5 when the value of the precious metals is deducted; in Arizona the figures were 8.3 and 7.5; in California 9.8 and 6.2 cents; to these figures 1½ to 2 cents must be added for transport, refining, and marketing. This was over two years ago; as conditions are now the total cost is nearly two cents higher all round, by reason of the rise in wages, scarcity of fuel, increased expenses of living, and so forth. Obviously the copper mine that does not also produce some gold and silver must either be abnormally rich in copper or must contain deposits, like the disseminated porphyry of Ely and Bingham, of vast extent, easily exploited.

The mines of the Boundary district of British Columbia during the year 1907 produced 35,500,000 pounds of copper at a cost ranging from 10¼ cents at the Granby to 14 cents at the Dominion mines, and at the present time, even with the help of the precious metals contained in the ore, any large production looks like exhaustion of resources without adequate profit. That certainly has been the characteristic of many copper enterprises during recent years; large sums of money have been expended in developing mines that never could give an adequate return on the capital invested, but they did produce lots of copper and spoiled the market, for to the consumer the metal that cost 15 cents looks exactly like that which cost only 10 cents to produce. The feline finance that inveigles the public into wild-cat gold mines may lead to the production of the precious metal at a cost of $100 per ounce, but the gold thus produced does not depress the price of the other gold that is dug out of profitable mines, which are being worked in a legitimate manner. The copper wild-cat, on the contrary, is a pole cat, for it produces unpleasant effects over a large area. The recent dehydration of the share market, especially as regards copper stocks, will discourage the organization of corporations to operate poor copper deposits and it may temporarily remove this one menace to the market. The publication of facts should check the flotation of undesirable ventures, while emphasizing the need of economy and skill in every kind of copper mining.

BY THE WAY.

In a recent issue of *The Evening Post*, New York, we find the following eminently sane comment on the recent unpleasantness:

Saturday's statement of the New York banks showed, for the first time since panic began with the Knickerbocker failure on October 22, a surplus over the 25% ratio of cash reserve to deposits required by law. In advance of this return to a surplus basis, the New York banks had resumed full cash payments to depositors; the currency premium had disappeared ten days ago; drafts on New York by banks of other cities are being met in cash; Chicago, Pittsburg, and Philadelphia banks are calling in for redemption the 'wage checks' issued during the currency famine. All this proves that the period of suspension of payments, complete or partial, is at an end.

With its habitual absorption in the future, the business community is now discussing nothing but the chances for or against a similar recovery in general trade. On this head, there is much to say; we shall at present, however, use the occasion rather to make some inquiry into the extraordinary episode which lies behind us. No doubt the most palatable comment would be congratulation to our financial institutions for having emerged from so formidable a crisis with relatively so little of outright insolvency. We shall not take this view. What, to our mind, stands out paramount in this panic episode is the refusal by the deposit institutions of this country during nine successive weeks, to return to its owners, on their request, the money deposited by them in trust with such institutions; the public sale at a discount during all this period, and in amounts running to the tens of millions, of certified checks on powerful and solvent banks, and, finally, the forcing upon wage-earners, by employers in half-a-dozen cities, of a makeshift currency not exchangeable for real money in the city of its issue and not receivable for payments in any other locality. Every one knows that this is a plain and accurate statement of what has happened; had such a state of things occurred in any other country than our own, our people would have described it as a shameful exhibition of weakness and bad faith. Why of all nations should the United States have been the scene of this extraordinary performance?

We are not among those who hold our currency system responsible. An ideal system—a central bank, an elastic currency—would no doubt have mitigated the after-effects of this break-down of credit; but we are convinced, along with the best European critics, that no currency system in the world would have stood up against such a raid on bank deposits as occurred in last October. But this merely shifts the inquiry to another question, why the money-hoarding mania should reach in this country, at such times, proportions never imagined elsewhere in the world, and why the various banking centres of the United States should stand out habitually as a dangerous menace to one another, the moment the American market falls into panic.

One explanation occasionally heard is that in affairs financial our people are impulsive, excitable, hysterical, and that just as they fling their savings into wildcat speculation during such speculative crazes as that of 1901, so, at a time of shaking credit, they see no recourse but to pull out their bank deposits and hide the cash. There may be some truth in this supposition. But the French are notoriously a more excitable people than our own, and they are, moreover, far more disposed to keeping their savings in the chimney-corner; yet nothing like this occurs in France. It must also be remembered that the practice of hoarding money, on the first signs of coming financial panic, has been directly encouraged by the experience of previous panics. The merchant, the small manufacturer, the dealer in land or produce, who remembered that in August, 1893, his bank refused for five weeks to allow him to draw from his deposit account the cash to pay his hands or consummate his purchases, cannot be wholly blamed if, in October, 1907, he is sorely tempted to get a supply of cash in hand before his bank shuts down on payments.

But if the trouble lies with the banks, what is it? Why should our fiduciary institutions be driven to this humiliating recourse, when it is never adopted elsewhere? We believe the simple and undeniable answer to be that our practice of redepositing bank reserves in banks of other cities, thereby diminishing the safeguard against deposits in the smaller cities, and entangling the banks of East and West with one another on a scale which no other community would dare to apply, creates a banking position which is certain to break down under strain of panic. Of the 6544 national banks in the field last autumn, 6178 were the so-called 'country banks' which by law are allowed to deposit with banks in other cities three-fifths of their 15% required reserve. Banks in the larger cities bid for these 'country-bank reserves' by paying interest on them. The result, as shown in the national bank reports just before the panic, was that, out of the reserve of these 6178 country banks, $420,000,000 was placed in more or less distant cities, and only $201,000,000 kept on hand in cash, where it could be used to meet, at a moment's notice, the demands of a run of depositors.

These figures seem to us to go far toward explaining the suspension of payments, the blockade of interior exchange, and the numerous resultant embarrassments, which mark such episodes as last October's. It will perhaps be rejoined that the Bank of England holds the reserves of others banks, precisely as do our larger banks in the 'reserve cities.' But the Bank of England maintains against such deposits a cash reserve, not of 25%, as in New York, but of 40% or over, and it furthermore would not dream of investing such funds in loans to Stock Exchange operators—the chief use which is made of them in New York. Our own belief is, that until these reserve provisions of the banking law are remodeled, or until the practice is modified by the banks themselves, the most perfect currency system in the world will not protect us, in the future, from repetition of such discreditable exhibitions as American banking has made of itself this winter.

Personal.

H. A. TITCOMB is in London.

JAS. W. ABBOTT is here from Pioche.

JOHN B. FARISH is at Globe, Arizona.

W. S. LECKY is with Mussens Ltd. at Montreal.

CURTIS H. LINDLEY has been at Redding this week.

ALBERT BURCH is examining mines near Tenabo, Nevada.

JAMES DOUGLAS has returned to New York from Arizona.

W. E. BURLINGAME, of Denver, was recently in Mexico City.

W. B. KEHOE, formerly at Ouray, Colorado, is at Boise, Idaho.

RODMAN SWIFT of Grass Valley spent a few days in San Francisco.

C. S. HERZIG has been examining mines at Bischofshofen, in Austria.

W. Q. WRIGHT returned this week from Goldfield to San Francisco.

GEORGE H. GARREY is examining mines at Taviche, in Oaxaca, Mexico.

ROBERT ARNOLD FOSTER is in San Francisco on his way to the Alaska Peninsula.

ALGERNON DEL MAR is visiting the new mining camps of Nevada. He is now at Rawhide.

W. H. BRYANT, formerly of Denver and now residing at Goldfield, is here for a few days.

J. R. FINLAY has returned to New York from a visit to the copper mines of Lake Superior.

ARTHUR AUSTIN, lately at Anaconda, is now with the Granby smelter, at Grand Forks, B. C.

BEN B. LAWRENCE is consulting engineer to the Nova Scotia Mining Co., operating at Cobalt, Ontario.

EDGAR RICKARD, business manager for the MINING AND SCIENTIFIC PRESS, is on his way to Chicago and New York.

A. A. HASSAN has severed his connection, as consulting engineer, with the Bishop Creek Gold Co., of Inyo county, California.

ALBION S. HOWE, BERTRAM HUNT and H. W. TURNER will have joint offices, although not partners, in the Mills Bdg., San Francisco.

W. ROWLAND COX has been appointed consulting engineer of the Inde Gold Mining Co. at Inde, Durango, Mexico; and is at present at the mines of the company.

ROBERT W. HUNT & CO. have established their St. Louis office, which is in charge of C. W. Gennet, Jr., at 1445 Syndicate Trust Bdg. They have arranged to place their chemical and cement laboratory in the same building.

FREDERICK W. BURRALL, superintendent of the Daly Judge mines at Park City, Utah, has resigned. He has accepted the management of a coal mining enterprise in Sweden which is backed by a syndicate of Boston capitalists.

ROBERT MCF. DOBLE, consulting and supervising engineer, making a specialty of hydro-electric power development and transmission, formerly of San Francisco, announces the removal of his office from Colorado Springs to 528 Majestic Bdg., Denver.

ROBERT H. RICHARDS has returned to Boston from Montana, where he has been installing some of his designs. He returned to his work of teaching at Massachusetts Institute of Technology, and to the further work on his third volume of 'Ore Dressing.'

ROYAL SCHOOL OF MINES.—The annual dinner of the past students in the Royal School of Mines will be held at the Hotel Cecil, London, on March 18, at 7 o'clock. The chair will be taken by Mr. Richard Pearce, Ph.D., Past President of the American Institute of Mining Engineers. Tickets can be obtained from the honorary secretary, Mr. George T. Holloway, 57 Chancery Lane, London W. C.

Latest Market Reports.

LOCAL METAL PRICES—Feb. 20.

Antimony	12@16c	Quicksilver (flask)	$45@45.50
Casting Copper	17½@18¼c	Spelter	6½@ 7¼c
Pig Lead	4.10@ 5.05c	Tin	33@34½c

ANGLO-AMERICAN SHARES.

Cabled from London.

	Feb. 13. £. s. d.	Feb. 20. £. s. d.
Camp Bird	0 15 6	0 14 0 ex div.
El Oro	1 0 0	1 1 10½
Esperanza	1 2 6	1 3 9
Dolores	1 7 6	1 7 6
Oroville Dredging	12 6	0 12 3
Stratton's Independence	0 2 9	0 2 9
Tomboy	1 7 6	1 7 6

(By courtesy of W. P. Bonbright & Co., 24 Broad St., New York.)

MINING STOCK QUOTATIONS—NEW YORK.

	Closing Prices. Feb. 20.
Bingham Central	½
Boston Copper	14
Cumberland Ely	7¼
El Rayo	1½
Giroux Con.	3¼
Nevada Con	9⅜
Nipissing	6⅛
Tennessee Copper	26¼
United Copper	5¾
Utah Copper	24¼

(By courtesy of Hayden, Stone & Co., 25 Broad St., New York.)

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date	Electrolytic Copper	Lead	Spelter	Silver
Feb. 14	13.12	3.73	4.83	57
" 15	13.50	3.73	4.83	55⅞
" 16	Sunday.	No market.		
" 17	13.56	3.73	4.83	56⅛
" 18	13.50	3.73	4.83	56½
" 19	13.38	3.73	4.83	56¼
" 20	13.13	3.73	4.83	56¼

SOUTHERN NEVADA STOCKS.

San Francisco, Feb. 20.

Atlanta	$ 31	Laguna	1.00
Belmont	1.30	Little Tonopah	.....
Columbia Mtn.	22	Manhattan Con	11
Combination Fraction	9	Midway	71
Daisy	1.12½	Mizpah Extension	05
Fairview Eagle	70	Mohawk	.....
Florence	4.15	Montana Tonopah	1.90
Gold Bar (Bullfrog)	37	Nevada Hills	3.00
Gold Bar (Goldfield)	25	Red Top	.....
Goldfield Con	4.70	Sandstorm	30
Goldfield of Nevada	.....	Silver Pick	29
Gold Kewanas	11	St. Ives	11
Great Bend	39	Tonopah Extension	1.20
Jim Butler	38	Tonopah of Nevada	5.00
Jumbo	.....	Tramp Con	23
Jumbo Extension	46	West End	30

(By courtesy of W. C. Ralston, 353 Bush St.)

COPPER SHARES—BOSTON.

	Closing prices. Feb. 13.		Closing prices. Feb. 13.
Adventure	.....	Michigan	7¼
Ahmeek	55	Mohawk	46
Allouez	26½	Nevada Con	9½
Amalgamated	.....	North Butte	43
Arcadian	3½	Old Dominion	32⅜
Atlantic	9¼	Osceola	77
Balaklala	.....	Parrot	13½
Bingham Con	7½	Phœnix	50
Boston Con	14	Quincy	78
Butte Coalition	17	Raven	.....
Calumet & Arizona	96	Rhode Island	3
Calumet & Hecla	610	Santa Fe	2
Centennial	21	Shannon	10¼
Con. Mercur	31	Superior & Pittsburg	11¾
Copper Range	56½	Tamarack	62
Daly-West	8	Trinity	13
Franklin	7¼	United Copper com	5¾
Granby	80	Utah Copper	.....
Greene-Cananea, ctf	7⅜	Victoria	4
Isle Royale	.....	Winona	5½
Mass	3¼	Wolverine	115

General Mining News.

ALASKA.

(Special Correspondence).—The President's message recommending "a simple form of local government," has been hailed with enthusiasm all over Alaska, but the ruling of the national committee, compelling the holding of another convention, is generally accepted as due to the influence of the Hoggatt-Whitehead-Guggenheim triumvirate, which was so severely checkmated by the friends of territorial government.——The scarcity of money is a serious handicap to Nome mining operators this year. It has been the custom of local financial institutions to assist mining operators in the development of paying properties, but little money is obtainable this year from the banks, no matter how gilt-edge the security.——A consignment of Cape Lisburne coal arrived in Nome on Dec. 10. It was freighted over the ice a distance of 600 miles in 16 days. Latest developments disclose three new veins of coal, which equals the best quality of that article imported from Seattle and British Columbia.——The usual complications over the surface and subterranean rights have begun in Nome, as in older mining camps, where the city was granted a patent for surface right and the miners also, to all privileges underneath the surface. The Nome-Smook Mining Co. has begun drilling at various points in the heart of the city (on lots owned by parties who live in the States), and driving in frozen ground under the principal buildings of the city is in progress. A continuation of the newly found submarine beach has been definitely traced at several points, a few hundred feet north of Main street, paralleling the sea-shore. This submarine beach was found last fall after navigation closed, and is known to extend from Nome river, underneath the heart of Nome's business centre, to Penny river, a distance of 10 miles. It lies on a clay bedrock about 25 ft. below sea-level, and is of uniform richness at all points where interrupted. The pay-streak in some places is over 125 to 150 ft. wide and 3 to 8 ft. thick. Fifteen cents per pan is claimed as a conservative estimate of its value.——A hundred feet north of the famous Bessie, Mable, Cyrus Noble, and Diamond L. mining claims, on the third beach pay-streak, another 'intermediate' beach deposit has been located that bids fair to rival all previous producers of beach-placer gold dust. Driving southward from the old workings of the third beach, on the same level, a series of 'mud horses' have been perforated that are lying on top of, and adjoining, rich beach concentrates. The knowledge of these conditions has stimulated unusually active prospecting.——John Bonnell, of the Nome Foundry & Iron Works, had his skull smashed to a jelly on Dec. 6. His brains protruded from the wounds, and pieces of his skull five inches long were removed. Strange to say, he is recovering.——First winter mail arrived in Nome by dog team from Seattle on Dec. 11, by way of Valdez and Fairbanks.——The tin mines of Lost river are working 15 men. The ore has improved considerably. Over a thousand feet of tunnels and drifts has disclosed big bodies of cassiterite ore, carrying tungsten, wolframite, galena and other by-products.——Nome and Seward Peninsula's coal product will be marketed at Tanana and Yukon points next summer. Big shipments will be sent to Siberia direct from the mines at tide-water on Norton bay.

Nome, Dec. 12.

Map of Alaska.

ARIZONA.

GRAHAM COUNTY.

At the Gold Belt mine near Clifton new machinery has been installed, and already the ore to a value of $202,000 has been blocked out or extracted. The shaft is down to 265 ft. and a cross-cut 150 ft. long has been driven to reach the main vein.——A contract has been let to drive an adit on the Gipsy mine at Morenci.——During the last two weeks some rich silver ore has been taken out of the Harper mine at Morenci.——The Arizona Copper Co. is receiving new consignments of machinery from the El Paso Foundry & Machine Co., which will be installed in the old smelter. The output of the smelter for January was 1441 lb. of blister copper.——The new camp of Stoddart is becoming important, owing to the high-grade ore being found in a new district. In the Binghamton mine a quantity of rich ore is developed, and the mines under development by the Copper Queen Gold Mining Co. are proving to be valuable. The shaft on the Binghamton is down 400 feet.

Rich copper ore has been struck in the Great Eastern mine at Globe, in three small stringers in quartzite formation.——Globe Cons. Co. continues development in the Gem mine and has driven a cross-cut 200 ft. long.——From the Malary shaft this company is hoisting some ore.——The shaft of the National Mining Exploration Co. has reached a depth of 500 ft., and the grade of ore is improving. It is reported that ore rich in copper and gold has been found on the Pinto claim, owned by H. Thomas.——Shipments have been made by the Big Spring Mining Co. from the Claire mine to the El Paso smelter.——At the Buffalo Hill mine a number of small veins carrying high-grade ore have been opened, but cross-cutting will be continued to reach a larger vein.

MOHAVE COUNTY.

The big strike of gold ore in the Richardson mine, near Union Pass, is said to be holding out well under continued development, and that many tons of rich ore are on the dump.——J. D. Spargo, who has a lease and bond on the Brown mine in the copper belt of Stockton Hill, has opened up a fine body of high-grade copper, gold, and silver ore.——Handsome specimens of gold in calcite have been taken by Thomas Lowell from a vein about 4 miles from the McCracken Hill mines.——J. E. Rose has been engaging teams to haul supplies and fuel to the hydraulic mine at Temple Bar.——C. W. Benedict is driving an adit to develop a body of good ore exposed in a shaft at a mine near Wallapai Springs.——In the cross-cut from the east drift

on the 100-ft. level of the Enterprise mine, a great body of ore is said to have been cut; it carries gold, silver, copper, and lead. A large part of the ore is of shipping grade, while the balance can be worked to a high-grade concentrate. W. A. Mensch is superintendent.——At the Gold Road mine several men are driving through the large body of ore recently found on the 700-ft. level; this ore is said to carry $28 per ton. At the Billy Bryan mine the three-compartment shaft is being sunk although the new hoisting plant and machine-drills are not yet in operation; J. De Salmard is superintendent.

YAVAPAI COUNTY.

(Special Correspondence).—W. F. Shaw and others are developing a promising group of claims on Wolf creek, in the Groom Creek district. Their claims are known as the Big Swede property. A tunnel is being run to tap the shaft, to drain a strong flow of water and also intersect the main lode.——The Empire mine and mill, another Groom Creek property, will soon resume operations on a larger scale than before. The mill is now making a test run, and ten additional stamps will be added as soon as it is determined just what is needed.——The great double-track adit being driven by the United Verde Copper Co., at Jerome, is now in about 3500 ft., and the drift from the 1000-ft. level is in about 600 ft. Work is not progressing rapidly, on account of the long haulage of waste, which is at present accomplished by the use of mules, but electric motors will soon be installed for that purpose.——A 32 hp. Morse & Fairbanks gasoline air-compressor is being installed at the Dillon tunnel of the Hull Copper Co. This tunnel is now in about 2700 ft. The drift from the '1888' claim is in 550 ft. and work is being pushed as rapidly as possible to connect it with the Dillon tunnel. G. W. Hull, president of the company, states that connection will be completed in about four months. He also states that their 50-ton smelter, which is already erected, will be blown in about May 1, 1908. An electric drill is expected from Denver, and will be installed in the 1888 drift as soon as it arrives.——The Sycamore company, operating on the Verde river about 13 miles from Jerome, has sunk the new two-compartment shaft to 325 ft. A good strike of ore was recently made, picked samples assaying 7% copper, $18 gold, and 6 oz. silver. A proposition is under consideration to install a complete water-power plant, as the Verde river will furnish an enormous amount of power, if properly harnessed.——The Haynes Copper Co., owning the Harry-hansen group of claims, is installing the heaviest plant in the district, exclusive of the United Verde. They are sinking a three-compartment shaft, but at a depth of 130 ft. a heavy flow of water was encountered, compelling them to abandon work until the arrival of pumps. They are at present putting into place three boilers, 50 hp. each, an 8-drill Ingersoll compressor, a double-drum hoist, and a Cameron sinking pump. This property is considered one of the best in the district, and developments are awaited with interest.——The main shaft on the Verde Grande has attained a depth of 530 ft. and sinking is progressing rapidly, under the supervision of Mr. Bevin. Developments have warranted the cutting of a station on the 500-ft. level. Numerous small veins of ore have been found, but no large orebody, although the presence of sulphides throughout the formation leads to the belief that a valuable ore deposit will soon be encountered.——The Little Daisy, owned by the Verde Extension Copper Co., is working right along. The main shaft is down about 700 ft. The flow of water is being handled nicely, but a depth has been attained that necessitates the installation of heavier machinery, and the showing in the mine is such that a large and complete hoisting and pumping plant will soon be placed on the property.

The Boston and Jerome property, adjoining the Verde Grande, is shut down, as the heavy flow of water could not be handled with present equipment. Joe Larsen, the superintendent, states that the proper machinery will be installed during the next 90 days.——The Pittsburg & Jerome property, which is being financed by Pittsburg capitalists, will resume operations about March 1.——The Mescal Copper Co. recently started development work on their property in Mescal gulch, near Mingus mountain.——The Two Republics Mining Co., operating near Mingus mountain, about 10 minutes from Jerome, is at present driving a tunnel, and expects to install machinery soon.——Rothermel & Ross recently acquired the Hogback property, below Jerome, and will begin development work at once.——The main shaft on the Arizona & Arkansas property, locally known as the Royal Irish, is down about 600 ft. A drift is being run from the 600-ft. level for the purpose of cutting a large dike.

Prescott, Feb. 10.

CALIFORNIA.

NEVADA COUNTY.

(Special Correspondence).—Extensive work is under way in the upper levels of the Brunswick mine. Most of the present activity is above the 1250-ft. level. The ore below this point is lower-grade than that found in the upper workings. The management has recommended to the stockholders that a new vertical working shaft be sunk and a large pump installed in the old shaft to handle the

water with one lift. No dividends were paid in 1907, but extensive development was accomplished. C. Mallon is superintendent.——The Greek vein has been struck in the Union Hill mine. Two good bodies of ore are being developed and several men are employed. The Wiltsee vein is showing well.——Sinking continues at the Kenosha and the vein is looking well. Some specimen ore was recently extracted and placed in the vaults of the Nevada County bank. A 3-ft. vein of milling ore is disclosed in the 65-ft. shaft at the Aurora mine. The ore runs about $10 per ton. A small force of men is employed and the shaft is steadily going down. The property was recently inspected by San Francisco shareholders, who were well pleased with the condition of it.——The vein on the 500-ft. level in the Idaho-Maryland continues to show well with increased depth. Considerable ore has been extracted and 10 stamps are dropping steadily. Limited work is going on at other points.——Sinking at the Central Shaft continues. Excellent ore is being developed.——Milling ore is being extracted from the upper levels of the Niagara mine.——A small force of men is developing promising ore in the Bear River mine.——At the Midas the shaft is rapidly nearing the point where it is expected to intersect the main orebody.——A limited amount of work is steadily prosecuted

at the Jenny Lind mine. A small crew of men is employed.——Good progress is being made in driving the cross-cut at the Conlan mine. Small quantities of high-grade ore are being developed in the shaft. It is announced that a large force of men will be employed, and that the company has ample funds to meet the claims against it.——At the Anchu mine a raise is being run to connect the upper and lower adits. The vein in the raise has widened to 6½ ft. The ore is of fair milling grade.——Negotiations are under way for the purchase of the Pittsburg mine by Oakland capitalists. This property has been idle for several years, although considered to possess merit.——A large tonnage of low-grade ore is being developed in the Champion mine. Rich quartz is coming from the Home workings.——It is rumored that the independent copper mine owners of the county are considering the formation of a merger which will facilitate the advantageous working of their properties.

Grass Valley, Feb. 10.

Twenty-five men narrowly escaped being suffocated by a fire in the Brunswick mine. One man, Harrison Eastus, is still in a dangerous condition. A number were hoisted to the surface unconscious from the effects of bad air. The cause of the fire has not been determined, as it is impossible to get to the point where it started. It is believed to be due to motors burning out at the 700-ft. level.——Eastus, the pump-man at that station, was startled by a loud explosion, and the next instant the pump station burst into flame. He attempted to check the fire with a hose, but was unsuccessful, and then started to the surface. He climbed 200 ft. but was there overcome by the smoke, and found later unconscious.——William Bawden made seven trips through the heavy smoke and assisted in bringing out every man. The fire is not expected to do much damage, as the timbering outside the pump station is too wet to burn.

The Murchie mine is now yielding in the lower levels a higher grade of ore than it had ever before produced; 20 stamps are crushing it.——A small vein of high-grade milling ore was exposed in the Belle Union mine by a round of shots fired while the directors were visiting the property.——A public meeting of the property owners and people residing on San Juan ridge has been called for the purpose of learning the sentiment as regards the movement on foot to resume hydraulic mining all along the ridge. It is proposed to conserve the waters and keep the debris on the ridge, so as to comply with the Federal laws. This means that the hearty co-operation of the people is necessary, as great lakes, restraining barriers and ditches would have to be constructed.——At the Aucho mine a raise which is being driven to connect the upper and lower adits has exposed good ore 6½ ft. wide. Several test runs of ore made in the 10-stamp mill gave satisfactory results: Harry Overman is manager.——Local papers announce the discovery in the Kenosha mine near Grass Valley of a rich ore-shoot "which is said to show a width of nearly four inches of solid gold."

PLACER COUNTY.

E. Witherspoon and J. Young are working a prospect on the North Fork of the American river near its junction with Granite creek. The gravel is rich with coarse gold. A number of men are working at the Eureka, above Westville, exploiting the southern vein. The channel has been found, but its extent and character have not been determined. W. C. Rose of Reno has secured an option on the Gold Blossom.——F. Pellon has bonded the California mine. This vein is an extension of the Bellevue and carries rich ore.

PLUMAS COUNTY.

Rich ore has been recently found in the Arcadia mine, at a depth of 500 ft. below the surface. The vein is said to be 3 ft. wide. The mine is on the south side of North Canyon, below the Round Valley reservoir, and is a part of the mineralized district extending through the Green Mountain range and extending westward to the North Fork of Feather river.

SACRAMENTO COUNTY.

A story comes from Sacramento that the Pneumatic Dredge Co., which is preparing the East Side Park tract for a pleasure ground, has discovered a pay-streak of gold-bearing gravel in the course of its excavations. The discovery of gold in some borings led to careful tests; the sand recovered from depths of 28 and 30 ft. gave an average result by assay of $1.02 gold per ton. It is thought possible that a great body of rich gravel underlies the State capital.

SHASTA COUNTY.

The Bully Hill Copper M. & S. Co. have contracted with Holt & Gregg of Kennett for the supply of 100 tons of lime stone a day. It is expected that the railroad to Delamar will be completed by the end of February, and that smelting will be immediately commenced. Three shiploads of coke are now in storage at Pit and other points on the railroad, waiting for transportation facilities to Delamar.——At Heroult, experimental work is being steadily continued on the electric smelting of Iron, with favorable results. Renewed activity in construction work will commence as soon as the weather improves.——The Midas mine at Harrison gulch has been worked continuously during the winter, and the Gladstone mine is a steady producer.

Map of Northern California.

At the Mammoth smelter the large Nordberg compressor has been started up. This machine has a capacity of 1700 cu. ft. per min., and is operated by a 750 hp. motor with a rope drive.

TUOLUMNE COUNTY.

The new 10-stamp mill of the Imperial group of mines at Jacksonville is running steadily. Costs are said to be 75 cents per ton, the ore being quarried. A. S. Kahl is superintendent.

COLORADO.

TELLURIDE COUNTY.

A fatal accident occurred at the Lewis mine in the Bridal Veil basin, caused by a slide, which demolished the shaft-house. Two men were killed.

GILPIN COUNTY.

Sinking is under way at the Slide mine on Pewabic mountain and a depth of over 100 ft. has been gained; Mark Harris is manager.——Lessees at the Two-Forty property in Harris gulch are shipping to the Argo plant ore that carries $18 to $20 per ton.——H. F. Pool & Co., who are working on the 440-ft. west level of the West Notaway mine in the Russell district, are reported to have shipped to the Chamberlain sampling works 5 tons of ore that carried $180 in gold, silver, and copper per ton.——Denver people who have taken a lease and bond on the Onoko and Parole properties in Leavenworth gulch, will

install the plant of machinery now at the Forks mine in the Nevada district.——Thompson & Hambly have the contract for the erection of new orebins at the Anchor mine in Willis gulch.——Driving is proceeding on the 220-ft. level of the Ingeborg mine at Winnebago hill; the lode is 3 to 4 ft. wide. Shipments have yielded 2½ oz. gold per ton. ——G. K. Gimball is having the water taken out of the Waltham mine in Russell gulch to permit an examination of the property.——The Tip Top claim, situated on the summit of Pewabic mountain has been sold to Illinois people; in the 60-ft. shaft there is a 4-ft. streak of mineralized quartz that is said to carry $8 to $11 per ton.

IDAHO.

IDAHO COUNTY.

A body of ore 11 ft. wide has been recently found in the Black Diamond mine in the Dixie district. High-grade ore has been found in a tunnel 180 ft. long in the Coeur d'Alene group of claims on Santa Ann creek.

OREGON.

BAKER COUNTY.

The new quicksilver smelter at Black Butte is being blown in. The smelter has a capacity of 500 tons per 24 hr., and is designed by W. Denis. The furnace has several new features, the wood fire being maintained above the stack, which is about 40 ft. high, and the hot gas drawn down through the charge by draught induced by electric fans. The mine has been developed to a depth of 1700 ft. and large ore reserves are blocked out.——At the Buffalo-Monitor mine, rich ore has recently been struck. The mine is under the management of N. Berkeley, the owner.

NEVADA.

ESMERALDA COUNTY.

(Special Correspondence).—Goldfield is quiet and dull; from appearances one would hardly imagine that troops were at any time necessary.——The new Goldfield Consolidated mill on the other side of Quartz Mtn. will in all probability be a model plant in every respect. The experience gained from the 20-stamp mill of the Combination mine should furnish valuable data for the new one. The present mill shows the effects of putting up a mill for an ore that is so changeable in character that a compromise process had to be adopted to suit the mixed product from the mine; the mill has had so many additions that it appears uncouth. The metallurgist in charge deserves sympathy. Grading on the new millsite and the grading of a road around Quartz Mtn. is the only work that has been commenced. The 20 stamps of the old mill are running but the concentrators have been cut out, probably for a test run. Outside of the work in the Combination and a few leases on the Florence, no mining work is being done about here. There are hopes of others soon starting up, but no positive information. The Florence mill, being put up by Mr. Hennesy, may take about two months more for completion. The process will be sliming of all the product without any amalgamating plates at all. The 20 stamps in units of ten are of 1000-lb. weight, with concrete mortar-blocks (six parts of sand and rock to one of cement) and wooden battery posts. The pulp, after being crushed to 12 mesh, will be screened, the fine going over Wilfley tables, the coarse being re-ground in a 19-ft. tube-mill lined with 5-in. silex blocks, and using flint pebbles. The oversize will then be ground in another tube-mill and concentrated. The cyanide department, arranged conveniently in the same building, will consist of six vats, Butters filters, and several zinc-boxes. The cost of the whole plant will be about $150,000, including about $25,000 for the pipe-line from Montezuma Mtn., and concrete water-tanks holding 250,000 gal.——The Pittsburgh Blair mill at Blair will soon be in operation.

Rawhide is about 25 miles east of the upper end of Walker lake. The population is about 2500 and the influx of people is unparalleled even in the history of mushroom camps. There is little good sleeping accommodation in the camp at present, but plenty of food can be had at reasonable prices. Water costs $2 a barrel and wood is now $35 per cord, but these prices will go down as soon as the effects of the recent storms are over. Pinon wood is obtained from the mountains about 25 miles to the south, and water from good wells 6 or 7 miles distant. Present indications suggest that the most valuable deposits of ore will be of good milling grade, and hence it is expected that the camp will have a great future.

The discovery is about a year old, but it is only during the last four months that there has been much activity. On the Kern lease, a shaft has been sunk 110 ft., in ore all the way, and now a 25-hp. gasoline hoist, the first application of power in the camp, is being erected. There are about 30 leases at work.——Good ore has been found in two shafts on the Grutt property.

ELKO COUNTY.

On Lime mountain a group of claims owned by Jacob Eggers is said to have a series of veins of high-grade copper-lead-silver ore; recently a cut 20 ft. long, 14 ft. wide, and 12 ft. deep has been dug entirely in copper ore.——At Ruby mountain, 55 miles south of Wells, the National Development Co. is driving two adits on a vein of high-grade lead ore; teams are hauling the ore to Wells for shipment to a smelter when the market improves.

Map of Southwestern Nevada, Showing Position of Rawhide.

HUMBOLDT COUNTY.

The Seven Troughs Leasing & Development Co., which is operating a lease on the Delaware property near Vernon, intends to install a modern hoisting plant and other necessities for rapid development work. The shaft is 200 ft. deep; numerous drifts and cross-cuts have been driven but as yet only ore of milling grade has been found.——A specimen of Mazuma Hills ore displayed in Lovelock weighed 70 lb. and was estimated to contain $30 to $40 per lb.——The Mother Lode Mining & Leasing Co. has increased its force at the Gold Run mine near Vernon.——Wheeler & Harris have found a promising vein on their property at the head of Stone Horse canyon.——It is expected that the new 10-stamp mill of the Seven Troughs Kindergarten Mining Co. in Seven Troughs canyon will be in operation on April 1.——At the Bard lease on the Seven Troughs Therein mine, there has been found a vein that carries $5 per ton.

——A 15-hp. gasoline hoisting plant is to be installed at the Gold Run No. 2 claim; the shaft is 85 ft. deep.——A strike of fairly good ore on the Yellow Dog claim of the Seven Troughs Fine Gold Mining Co. has caused several lessees to resume work.——An adit is being driven at the Seven Troughs Tomboy property.——On Feb. 6 a big rush to a new gold discovery 10 miles west from Brown station started in Reno. The cause was the discovery on Feb. 2 of some very rich specimens of gold quartz that are described as being "of that gold-spangled, gold-studded variety which is comprehensively denominated picture rock." John and Joseph Macidon of Lovelock made the discovery and they have staked all the claims they want.

LANDER COUNTY.

(Special Correspondence).—The Hider-Nevada Co., with John J. Broecher as manager, is developing a group of claims in Wild Horse range, situated 24 miles south of Battle Mountain and 9 miles west of the Nevada Central railroad, which extends to Austin. This mountain range is made up of beds of dolomite having a north-south strike and a dip to the west. The ore occurs in garnet zones, of which there are four, running parallel. Within these are lenses of ore in a garnet and silicious gangue, the copper being oxidized. A 120-ft. shaft cuts mainly through a gossan, but at the bottom of the shaft a body of ore was entered that is 2 ft. wide, running over 16% copper. On the same belt a 70-ft. shaft has been sunk, and in it was encountered a vein 15 ft. wide, the ore in which runs 2% copper. A portion of it is said to run 5% copper. In the bottom of this shaft a sulphide ore was found that carries 9 oz. silver and $1.60 gold per ton. The intention is to sink a 500-ft. shaft and from it run cross-cuts through the formation at various levels. A diorite dike that is said to be mineralized crosses the mineral belt herein described.

Battle Mountain, Feb. 14.

LYON COUNTY.

At the Homestake mill, the retaining walls and battery foundations are finished, and it is expected that the construction work will be finished during May.——It is stated that the Ramsey-Comstock mine at Ramsey has been examined by engineers representing Samuel Newhouse. A few shipments have been made, but the mine has been systematically developed and a considerable tonnage of ore is now ready for extraction. The Ramsey-Comstock was discovered by Charles Clark in April, 1906, and sold to A. H. Mayne and his associates, who developed it on four levels by several drifts.

The Western Gypsum Co. has arranged to ship two carloads of gypsum per day from Mound House to the plant between Reno and Sparks and to the old plant in San Francisco.——The Nevada-Douglas company has a smelter site of about 85 acres of ground on the dry lake-bed in Smith valley where it will be isolated from the rich agricultural section of the Yerington district.

NYE COUNTY.

Good progress has been made on the M. & M. lease on the Great Western mine. The shaft is sunk to 140 ft. and cross-cutting to the south has been begun. The gold has been found associated with a talcy material stained with hematite.——The Great Western Mining Co. has passed into the control of the Round Mountain Mining Co. This company's mill has been averaging 72 tons of ore per day. The January clean-up amounted to nearly $30,000.

Tonopah shipments last week amounted to 5608 tons. At the Midway sinking continues on the winze from the 835 level, which is down 120 ft.——From the Belmont 950 tons were extracted last week, principally in the course of development.——On the North Star, drifting is being continued on the ledge which was struck on the fault-plant at the 1250-ft. level, about 560 ft. north of the shaft.——The Tonopah Mining Co. continues to drift westerly on the Valley View ledge on the 240, 340, and 440 levels. Good ore is being encountered in each drift.——Cross-cuts have been run north about 600 ft. west of the shaft, on the 340 and 440 levels of the Silver Top claim, and as a result a body of good milling ore has been found.——On the Mispah, ore is being extracted from all the levels down to the 600 level, where good ore is being stored in the Mispah vein, west of the shaft.——In the Montana-Tonopah, a body of ore over 8 ft. wide has been encountered at a depth of 462 ft., about 200 ft. east of the shaft. Drifting is progressing on the Martha ledge on the 600-ft. level, about 950 ft. west of the shaft, following the new discovery and going northeast on the vein.——Drifting is being continued on the Macdonald vein to the west, about 600 ft. from the shaft, disclosing a good vein 6 ft. in width.

STOREY COUNTY.

Last week Ophir produced 332 tons of ore, valued at over $18,000. Favorable reports also come from Andes and Yellow Jacket. In the former, ore has been found at a depth of 250 ft. and the latter is producing 150 tons of ore per day.

WHITE PINE COUNTY.

The Nevada British Mining Co. has erected a 40-ft. gallows frame, installed a gasoline hoist, and has a force of men sinking the shaft at the Chief of the Hills mine near Cherry Creek; a compressor plant will be put in soon and the shaft will be sunk to a depth of 800 ft.——The Nevada Mother Lode Mining Co. has let to Ryan Bros. & Taylor a contract to drive an adit 800 ft. long at its mine in Silver canyon. Two Sinclair air-hammer drills have been installed; J. W. Walker is manager.

UTAH.

BEAVER COUNTY.

The Star district is now attracting considerable attention. The Hub property, owned by the Utah Mining & Transportation Co., has been opened to a depth of 200 ft. and down to this depth the workings have been in splendid ore. One shoot, 5 ft. wide, is rich in silver, lead, and copper.——Another body of ore, rich in lead and silver, has recently been opened by the Buckeye Cons. Mining Co.

CANADA.

BRITISH COLUMBIA.

A. J. McMillan, managing director of the Le Roi, and W. A. Carlyle, consulting engineer for the same company, are at Rossland examining the affairs of the company. The latter left Rossland about seven years ago to take charge of the Rio Tinto mines in Spain. He was previously in charge of the Le Roi, Columbia-Kootenay, and Nickel Plate mines. The following tonnage of ore was shipped from the Rossland mines during the week ending Feb. 8: Centre Star, 2840 tons; Le Roi, 1925 tons; Le Roi No. 2, 743 tons; Evening Star, 30 tons. A petition has been presented to the Dominion Government by the owners and managers of the silver-lead mines, asking for an extension of the lead bounty. Only a fraction of the original appropriation has been expended, and it is thought probable that an extension will be granted. The Nelson Board of Trade has sent J. L. Retallack to Ottawa to work for a continuance of the lead bounty, which bounty expires next June.——At a meeting of the directors of the Sullivan Group Mining Co. it was announced that the Sullivan ore is self-fluxing and that in the future no ore will be shipped from outside points for fluxing purposes.——A carload of rich galena ore has been shipped to the Trail smelter from the Lightning Peak mine on the west shore of Arrow lake; all the ore had to be rawhided down the mountain for many miles.

NOVA SCOTIA.

At the Micmac mine, in the Bridgewater district, a hydro-electric plant is being installed, and the production will be increased to 100 tons per day. The ore developed carries from $10 to $11 per ton and has an average width of 2 ft.

The generating station will be 9 miles from the mine, and the power should cost about $7 per hp. year. At the present time the output is 30 tons per day, with steam power costing $100 per hp. year, and the profit is $5 per ton. It is expected that the increased output and electric power should increase this to $7 or $8 per ton.

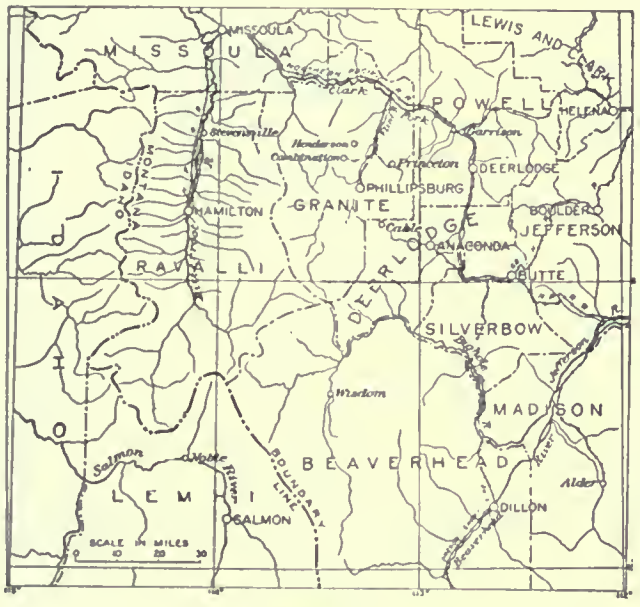
Special Correspondence.

BUTTE, MONTANA.

Amalgamated Mines.—Boston & Montana Operations.—Fighting Fire Underground.—Developments in the Greenleaf.—Davis-Daly Mines.

There have been numerous rumors circulated that the mines of the Amalgamated Copper Co. would resume operations by May 1, but if the Eastern officials have arrived at any such conclusion it is news to the officers of the company here. Still, they say, they would not be surprised if work were resumed in May, that being a long way off. Their surprise would be rather if the mines remained closed that long.

The changes and improvements being made at the Boston & Montana concentrator at Great Falls will be completed by March 1, and the shipment of ore from the mines at Butte will be increased by about 400 tons per day. The present shipments average



Montana.

about 3300 tons per day, and a portion of that is stored at Great Falls, the smelter and concentrator handling only about 3000 tons. The Boston & Montana Co. is maintaining 4000 men at its mines in Butte by working half at a time for a period of two weeks. Ore is coming from the Mountain View, West Colusa, Leonard, Pennsylvania, and East Colusa. Fight against gas and fire in the Leonard and West Colusa is going on. The Mitchell shaft, which was sunk in the neck of the Minnie Healey ground, owned by the Butte Coalition Co., has broken into the fire zone, and the Boston & Montana officers have now become convinced that the seat of the fire is in the Butte Coalition ground, where they at first suspected that it originated. Pipes have been put through the bottom of the shaft into the fire and streams of water have been turned on. Two other shafts, on the Gambetta, are being sunk near the Mitchell; one of them has reached a depth of 670 ft. and the other 500 ft. The Mitchell shaft had reached a depth of 870 ft. when it struck fire. It is claimed that within a month the Boston & Montana will be working in all parts of the Leonard and West Colusa again, as the fire has been thoroughly hemmed and walled in, and when the two Gambetta shafts get a little deeper it is expected that they will be able to take care of all the gas arising from the fire. A new electric pump is being installed on the 1200 of the Leonard to assist in taking care of the water that is sent into the mine. The water pumped out is rich with copper solution.

Cross-cutting has been resumed in the Greenleaf, where the Boston & Montana Co. is doing development work. A heavy flow of water was opened in a cross-cut that was started north from the shaft on the 1000-ft. level, and all work had to be stopped until a pump was installed. There are two other pumps in the Greenleaf shaft, with a combined capacity of 600 gal. per min. The north cross-cut is only a prospect, though it is known that there are several veins in that direction. The southern cross-cut is in the direction of the veins that were cut by the shaft, and the first one will be reached within 200 ft. The only work that is being done at any other mines of the Amalgamated Co. is in re-timbering a portion of the Parrot shaft and keeping the shafts at the other mines in repair.

The Davis-Daly Co. is working in two cross-cuts and a drift in the Colorado, about 30 ft. being made in all of them per day. The drift is being run eastward with the object of intercepting the vein recently opened by lessees in the Lizzie claim, another Davis-Daly property. The Lizzie vein strikes northwest, and has been developed to a depth of 200 ft. by the lessees. No other work is at present being done by the Davis-Daly. It was expected that exploration would be resumed in the long cross-cut that was driven from the 1800 level of the Original mine, through an arrangement with Senator Clark, but financial conditions have delayed a resumption of that work, and it is a question of money when work will be resumed there. The company's management is confident that a big mine will be developed through the Colorado. The Lizzie vein will be reached within a distance of 600 ft. from the Colorado shaft.

TORONTO, CANADA.

Settlers' Rights to Mineral Land.—Coal Development.—Shipments From Cobalt.—The Lemieux Act.

The minister of Lands and Mines has introduced a bill in the Ontario legislature amending the Public Lands Act. It provides that when lands not valuable for mines are thrown open for settlement the settlers shall be entitled to all minerals found therein. The measure has also a retroactive effect, and rescinds all reservations of minerals in patents heretofore issued, in cases where the title to mineral rights remains in the Crown and has not been granted to anyone under the Mines Act. The reservation of mines and minerals in lands taken up by settlers has been the cause of much trouble between settlers and prospectors, and the owners of surface rights have been often subjected to disturbance by those subsequently acquiring mining rights on the property.——The Canadian Pacific Railway is undertaking the development of its coal areas at Hosmer, in the Crows Nest region, on an extensive scale. A subsidiary company has been formed, the directors of which are leading Canadian Pacific officials. W. H. Aldridge, consulting mining engineer of the company, is superintending the building of the town, the sinking of shafts, and the installation of modern machinery. The company will spend between one and two million dollars on development work. Eight seams will be opened, the product of all being brought up by one adit. Provision is being made for an output of 3000 tons per day, and it is hoped to begin raising coal by 1909. Most of the coal will be used as fuel for the company's locomotives.

Shipments of Cobalt ore for the week ending February 1 amounted to 371 tons, from the following

mines: Buffalo, 55 tons; Cobalt Lake, 25; Foster, 34; La Rose, 20; Nipissing, 29; O'Brien, 143; Silver Leaf, 32; Temiskaming & Hudson Bay, 33 tons.—— Shipments for the week ending February 8 were 269 tons, contributed by the following: Drummond, 26; King Edward, 31; La Rose, 21 tons; Nipissing, 32; O'Brien, 95 tons; Temiskaming & Hudson Bay, 33; Watts, 30 tons.——The Divisional Court at Toronto gave a decision on February 12 in the appeal case of James McGuire, an official of the Western Federation of Miners, who was convicted by the Police Magistrate of Cobalt of unlawfully inciting the employees of the Nipissing Mining Co. to strike, and fined $500 or six months imprisonment. The Court found the conviction defective and ordered the papers to be amended and the term of imprisonment reduced to three months. The presiding judge strongly criticized the Lemieux Act, under which the proceedings were taken, as being full of defects.

DENVER, COLORADO.

Portland Litigation.—Open Shop.—Bob Womack.—Upper Clear Creek.—Dry Concentrators.—Activity at Cripple Creek.

The now famous Doyle-Burns case is to be reopened again. This case involves the transfer of about $1,000,000 worth of stock in the Portland Gold Mining Co. It has dragged along through the courts for more than six years, and is now no nearer settlement than at first. Neither party will accept a decision when it is against him. The latest move is the filing of a motion in the District Court at Council Bluffs, Ia., for a change of venue from Pottawattomie county to some other county of the fifteenth judicial district. There are so many laws in the statute books now that it seems needless to enact more, but certainly there should be fixed by law a reasonable length of time at the end of which a case between parties or individuals must be finally settled.

Notices have been posted in the Rio Grande railroad shops at Denver and Grand Junction that after March 13 all agreements with the men as to wages, hours of labor, and other conditions will be abrogated. This is evidently an endeavor on the part of the railroad to adopt the 'open shop' policy.—— The *Colorado Springs Gazette* has started a fund for the relief of Bob Womack, the discoverer of Cripple Creek. The usual fate of a prospector was his. Others have been enriched by the great camp he brought to the world's notice, and now it is pleasing to see the generous contributions to the fund for his relief. Womack is a helpless paralytic and absolutely dependent upon his sister for support. The various newspapers of Cripple Creek and Victor have also joined in the work.

Upper Clear Creek district is more active than is usual at this time of year. The shipments for January showed an increase of nearly 25% over the production of the same month for the past two years. The owners of mines producing lead ore are rejoicing over the new schedule announced by the Chamberlain-Dillingham sampler at Georgetown. While this schedule is favorable on lead ores it is still too low on zinc ores to be of any assitance to those mines that have had to close on account of the price of zinc. Lessees in the Mendota mine at Silver Plume have developed a small body of ore and there are several applications for leases on the Seven-Thirty and Burleigh Tunnel properties.——A great deal of ingenuity is being displayed by inventors who are trying to develop dry concentrators and amalgamators for working dry placers. There are two of these machines on exhibition now in Colorado Springs. The concentrator is the invention of McKesson and Black, who have a satisfactory dry concentrator with a wide range in treating unclassified material. The amalgamator has been patented by Louis Chandler. It is designed to pass the sand over eight troughs filled with quicksilver and agitated by a spiral screw. It is evident from the results already obtained in the treatment of ores where water is scarce that dry concentrating will soon be an important branch of ore-dressing.

Confidence in Cripple Creek is more in evidence as the month progresses. The secretaries and general managers of several of the mining companies report numerous applications for leases, and almost daily some new agreement is filed for record.

SALT LAKE, UTAH.

Utah Con. Smelter.—The Yampa Mine.—Utah Copper Concentrator.—A Large Plant.—Interesting Details.

The Utah Consolidated Mining Co., owner of the Highland Boy mine at Bingham, has made a year's contract with the American Smelting & Refining Co. to ship 800 tons of ore per day to the latter's Garfield smelter, with the privilege of renewal at the end of the first year. This contract was the result of the injunction order forbidding operation of the Highland Boy copper smelter, as asked for by the farmers of the valley. The intention of the Utah Consolidated Co. is to erect a new plant at a site where its smoke and fumes will not menace the farmers. It is understood that plans and drawings for the proposed new plant are complete. The site has not been announced.

It has been decided by the Tintic Smelting Co. to install a copper furnace, 48 by 108 in., in addition to the lead furnaces now in course of installation.

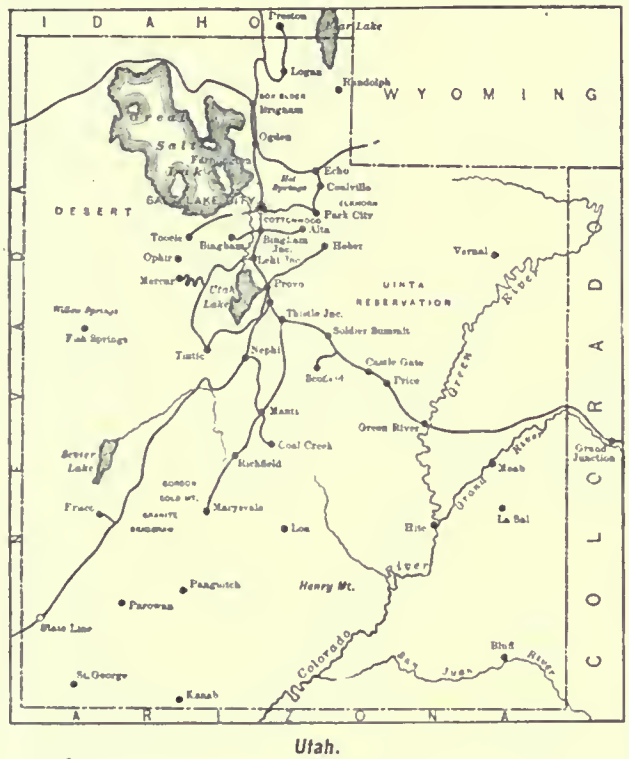
The Yampa mine at Bingham was recently equipped with a new Ingersoll-Rand air-compressor, which will result in increasing the drill force. At present 30 drills are in use. The Yampa is opened by a 3000-ft. haulage adit, in which electric power is used. This main adit first strikes the vein obliquely and then follows along its strike. It is connected with an incline that goes to the surface at about a 30° angle, on the dip of the vein. This adit is considered the 1200-ft. level of the mine, most of the present mining being done above it. The orebody, as shown by the workings, ranges in width from 8 to 16 ft. J. C. Dick is general superintendent.

The Jennie Gold Mining Co., whose property is at Gold Springs, 14 miles from Modena, is operating a mill that is equipped with 12 Nissen stamps, with an amalgamating plate in two sections below each stamp, followed by a Pierce amalgamator. In this way the mill is treating 75 tons per day. Equipment is being put in for separating the sand and slime; also agitating tanks, leaching vats, and a Kelly filter press. The ore, carrying gold and silver, runs $10 to $12 per ton. C. A. Short, who has been connected with the property for several years, is manager. The mill was designed by the General Engineering Co. of Salt Lake.

The Utah Copper Co. is treating 800 tons of ore per day at its Copperton concentrator and 4000 tons per day at its new Garfield plant. As soon as all sections of the latter are set in operation the plant will be handling 6000 tons of ore per day, this being the capacity for which it was designed. The Garfield plant is composed of twelve 500-ton units, eight of which are in operation. The ninth unit is expected to be in operation by February 15, and the three additional units will doubtless be ready within 60 days. Each 500-ton unit is a mill complete within itself and may be operated independently of the others. Thus an accident or any breakage requiring

repairs in the machinery of one unit does not affect operations of the other units. The dimensions of the plant proper are 600 by 508 ft. The ore-bin, adjacent to the main building, is 600 ft. long, 40 ft. wide, and 24 ft. high. The area covered by the main building and ore-bin is equal to seven acres, while the floor space in the main building aggregates over eight acres.

The three principal features of the milling process employed consist of coarse crushing, fine crushing, and concentrating. In the coarse crushing department there are four No. 7½ gyratory crushers, each having a capacity of 100 tons of ore per hour; and four 54 by 20 in. roughing rolls. The crushers and roughing rolls reduce the ore dry to ¾-in. size. After leaving the coarse crushing department, the ore is subjected to wet processes. The fine crushing department contains 36 six-foot Chilean mills and 24 sets of 16 by 36 in. rolls. The method and arrange-



Utah.

ment of the crushing departments necessitate the use of a number of elevators to take the crushed material to the trommels for sizing. The fine-crushing machinery reduces the ore to 40-mesh before passing it to the concentrating department. The equipment for concentrating consists of 72 single two-compartment Hartz jigs, which serve as separators and sizers, for no jig product is made; 48 Wilfley tables, which stand at the head of this department, handling the coarser material; 1104 six-foot vanners of the suspended type and a modification of the Johnston vanner; 24 four-compartment classifiers, and 384 nine-foot conical settling tanks. All this machinery is set on re-enforced concrete floors, supported by steel columns. Those vanners handling the coarser material have corrugated surfaces, while those treating the slime have smooth surfaces. The concentrate from all the tables passes automatically into concrete settling tanks, where the water is drained off through filters, after which the concentrate is loaded into railroad cars by an electrically operated crane with clam-shell bucket.

The mill is provided with a system for heating the air by steam coals, taking the exhaust from the engines that drive hot-air fans. The water supply for mill work and fire protection is supplied from two reservoirs above the mill—one for high pressure and the other for moderate pressure. These are kept filled by a pumping plant that throws 10,000 gal. per minute.

All mill machinery, pumps, and shop machinery are operated by electric power, generated by the Utah Copper Co.'s own plant, in close proximity to the mill, which is one of the largest and most modern that exists west of the Mississippi. Its equipment comprises 20 water-tube boilers, of approximately 12,000 hp., which drive five cross-compound condensing engines, each direct connected to an alternating current generator. Two of these generators are 1500 kw. each and the others are 2250 kw. each.

According to the annual report by D. C. Jackling, the general manager, the Utah Copper Co. is now producing copper at the rate of 3,000,000 lb. per month, at a cost of less than 8½c. per lb., and he predicts that the company will be producing copper at a cost of 7¾c. per lb. within the next 12 months.

MEXICO.

Santa Eulalia.—Purchases by Schwab.—The San Toy.—Railroad From Gutierrez.—National Finances.—Splendid Surplus.—Exports and Imports.—Production of Metals.

The failure last fall of F. August Heinze prevented the completion of the deal for the purchase of the holdings of the Potosi Mining Co. and the Chihuahua Mining Co. (controlled by Grant B. Schley and associates of New York and Dennis Sullivan of Denver) in the Santa Eulalia district of Chihuahua. Examinations were made at the time, as mentioned in these columns. After the failure of Mr. Heinze the option, if such there were, passed to others (presumably to Chas. M. Schwab and friends), for whom a thorough examination of the Potosi and Chihuahua properties has just been completed. Coincident with the completion of this examination, Donald B. Gillies and Malcolm MacDonald, both Schwab men, left Chihuahua for the United States, either Pittsburg or New York. It would seem therefore that there is no question that the Schwab interests are behind the deal. And as Mr. Gillies is president now of the San Toy Mining Co., of Santa Eulalia, and this company and Mr. Schwab have both made public denial of having or ever having had any connection with the Dolores suit, in which J. P. Hutchinson, former manager of the San Toy, is interested, and as in that denial Mr. Schwab took occasion to state that Donald B. Gillies was his representative in Chihuahua, and further, as it has been known that Mr. Schwab is largely interested in the San Toy Mining Co., it is not far fetched to draw the conclusion that a consummation of the deal for the Potosi-Chihuahua means an immense consolidation of all the holdings of the Chihuahua Mining Co., the Potosi Mining Co., and the San Toy Mining Co., than which only the Greene-Cananea combination can be looked upon as larger in the whole of Mexico. The Potosi mine has been said by many who have had the privilege of visiting it to have opened up the largest bodies of silver-lead carbonates and argentiferous iron ore on this continent, and it is an immensely rich zinc carbonate property as well. The Chihuahua has been shipping in the neighborhood of 300 tons per day for many years and seems only to be limited by the transportation facilities available. The San Toy has only in the last year become a large shipper, but large bodies of low-grade ore are opened up and the production can easily be increased to 300 or 400 tons per day. Those who have kept in close touch with operations in Santa Eulalia state that the only question as to the completion of this deal is the ability of the Schwab coterie to raise at the present time the money required for the transaction, for the size of

the properties and the standing of the sellers (practically the Standard Oil) means that it will be no small sum. The San Toy Mining Co. has completed its new extension of one mile of tram, which will give service from the terminus of the aerial tram, completed last spring, at the Galena shaft. This tram is 4½ miles long and reaches to the Bustillos, Central, and Juarez mines, which three were bought last year from Manuel Gameros by Donald B. Gillies for the San Toy. The new extension of the tram also passes the San Juan and El Cristo, on which J. P. Hutchinson, former manager of the San Toy, has obtained a short option.

Whoever has been called upon to make that stage ride from the station of Gutierriz on the Mexican Central to Sombrerete, in the State of Zacatecas, leaving Gutierrez at midnight and arriving at Sombrerete at noon, than which for the same length of time there is none worse in Mexico, will be pleased to learn that the first 40 kilometres of the railroad to be built between the two points has been permanently designated by the Mexican Western Construction Co., under the direction of V. P. Safford, and grading will be started as soon as the line has been approved by the Government. The total length of the road when completed to Sombrerete will be 135 km., and if extended on to Chilchihuites it will be about another 40 km., while if continued on through to Durango, as it should be in order to take in other mineral districts, as Vacas and La Parilla, and the agricultural lands around Nombre de Dios, as well as to give a decided short cut between Durango and Mexico City, it would have a total length of something like 300 km. or 185 miles. This is a road that should have been built many years ago, and had it been done R. S. Towne, who is behind the present move, would have saved almost enough to have paid for its construction from the costs of his wagon freightings to and from his Sombrerete mine, of the Sombrerete Mining Co., or the Mexican Metallurgical Co., of which he is president.

Of great importance to all who are interested in Mexico must be the report to the Mexican Congress of the Minister of Finance, Julio Ives Limantour, for the last fiscal year, ending June 30, 1907. The most important item in this report is the splendid surplus, amounting to 29,209,482 pesos, the largest in the history of the Republic, and considerably in excess of the entire revenue for 1886, which amounted to 26,980,895 pesos, a most remarkable showing in 21 short years. But a little over a dozen years ago such a thing as a surplus in the country's finances was looked upon as an impossibility. It was under such conditions that Mr. Limantour took up the ministry of finance; many reforms were at once instituted, the country began to be credited abroad, and at the end of three years the results became manifest, the unexpected occurred, and the fiscal year 1896 closed with the first surplus ever known, amounting to 5,451,347 pesos. From that time the revenues have increased steadily, but the surplus, though maintained, has varied greatly until in 1903, with a revenue of 76 million pesos, the surplus amounted to 7 millions, then 10, then 12, then 22, and last year over 29 millions of pesos, as stated above, the total revenues for 1907 amounting to 114,286,112 pesos and the expenditures to 85,076,640, this latter being an increase of 7% over the expenditures of the preceding year. The sum total of all surplus amounts since 1896 foots up to something over 111,500,000 pesos, but in addition to ordinary expenditures over 35,000,000 pesos has been expended in public improvements, such as port works, waterworks, warships, buildings, sanitation, city utilities, and improvements, so that the cash reserve on June 30, 1907, amounted to 75,646,700 pesos. The public debt on that date was 444,530,711 pesos. During this fiscal year Mexico's imports amounted to 233,000,000 pesos and her exports to 248,000,000, a balance of trade in her favor of 15,000,000 pesos. Of the exports 176,000,000 pesos and of the imports 146,000,000 pesos were in trade with the United States. What the mining interests of the country amount to is readily shown in a slight classification of the exports as follows: Mineral products, 160,246,003 pesos; vegetable, 71,810,374; animal, 11,151,928; manufactured and sundry products, 4,809,602; showing thereby that over 64% of the total exports were mineral products. Of these 160,000,000 pesos of exports from the mines, gold was exported to the amount of 23,873,713 (the total production of gold being 36,563,898 pesos and the surplus of production over export being coined by the Government for circulation in Mexico); silver was exported to the amount of 99,861,790 (the total production of silver being but 77,088,827, so that the increase of export over production was made up of silver coins in actual circulation in Mexico, an amount almost exactly equal, as may be seen above, to the gold coined and added to the circulation); and the copper exported amounted to 28,792,779 (5,000,000 in excess of the gold exported), leaving 8,000,000 pesos as the value of the lead, zinc, antimony, and other metals exported. Mr. Limantour's report goes on to show that only seven of the products exported were in excess of 5,000,000 pesos (silver, copper, and gold as shown; henequin amounting to 31,440,246 pesos; hides and skins, 8,909,974; coffee, 7,237,529; and rubber, chiefly guayule, 6,678,926), and he calls attention to a much needed diversity in the country's enterprises, for, as they are now limited, the country as a whole is too liable to disaster from a fall in prices or demand of a few articles, as is now the case by reason of the fall in prices of silver, lead, and copper.

The chartered banks of the country show a capital subscribed of 162,600,000, an increase of 16,000,000 over the previous year; assets and liabilities, 723,763,584.96, an increase of 94,881,750.12 over the preceding year; the accounts current were 260,080,521.24 pesos, and the total cash 75,247,200.05. The total railroad earnings on freights were 53,529,981 pesos (an increase of 9.3%) in the handling of 9,538,354 metric tons(an increase of 6.4%); and on passengers, 15,942,776 pesos (an increase of 30.7%) in the handling of 10,187,121 people (an increase of 16.7 per cent). Certainly the best fiscal year for the Republic of Mexico.

The locator of mining claims in Mexico will learn with pleasure that the land office has issued instructions to the various agencies for engineers and surveyors to the effect that in future they will be required to give more data in the description of the location of claims and more exact maps. It is an exaggeration to say that there is not a mining camp in Mexico free from a woeful mass of errors, due partly to the ignorance but chiefly to the carelessness of the Mexican engineer. Many are the tracts of ground, fractions, etc., that are not covered by denouncements and belonging to no one because of misplaced corners, but they cannot be denounced because the plans show the ground as covered and the acceptance of a location thereon by the Government would be an admission of the inaccuracy of the plans. Nor can they be worked, because an adjoining claimant may lay claim thereto, and so it remains truly 'no man's land' unless some wily neighbor quietly moves his corners so as to take in that which is not supposed to exist and has no existence on the records. It is hoped, therefore, that the new orders may compel an accuracy and care in the future that has been long wanting in the past.

LONDON.

British South Africa.—Conditions in Rhodesia.—Consolidation of El Oro Companies.—A South American Venture.—Copper in the Transvaal.

The shareholders of the British South Africa Co. met together this week in great force to listen to speeches delivered by Henry Birchenough, the Marquis of Winchester, and B. F. Hawksley, the subject being the present state of development in Rhodesia. Your readers are probably aware that Rhodesia is not progressing so rapidly as its founders hoped, or as the shareholders desire. For many years we have been accustomed to financial statements saying that as yet the expenses have been greater than the income, but that the succeeding year promises an equalization of these items. Not only have the shareholders been disappointed, but during the last year or two there have been serious signs of discontent in the country itself; so much so that the directors were forced to send a special deputation for the purpose of arguing the case with the population of the country and of ascertaining if anything could be done to remove the manifold grievances. This deputation spent several months in Rhodesia and reported to the directors, who took steps immediately to remedy some of the defects of organization. The news in connection with these innovations and concessions has been published some weeks ago, so that the shareholders were pretty well posted. The shares in the chartered company are as dull as ever, remaining at about 15 shillings. Some years ago, in the boom times, these pound shares stood at £8, and on several occasions the new issues of shares were made at high premiums. It is not necessary to go into details about the new regulations. The new rules about royalties due to the Government from the gold mines are head-aching in their complexity. Nobody but a skilled accountant could follow them. What keeps Rhodesian development back is the absence of bonanzas and the plentiful supply of rules and regulations. There were bonanzas in the West of America to attract a population and open up the country, whereas in Rhodesia there is nothing but low-grade or refractory ores, the bonanzas having been worked out by Solomon or the Queen of Sheba. In the West of America there were no rules and regulations; communities, laws, and governments were not formed in advance of industry. There is another reason why the population does not increase rapidly in Rhodesia, namely, the opposition of the present settlers to the dumping of criminals and ne'er-do-weels in their midst. I am compelled by stern logic once more to make a comparison with Western America, but I shall only go so far as delicately to hint that the characters of the early pioneers west of the Mississippi were not all above reproach.

There appears to be some prospect of the once-famous Emma mine being sold. This mine is situated in Utah, and was floated in London by the late Baron Albert Grant for a large sum of money, more than 20 years ago. For a year or two the profits were large, but its end as a large producer came very soon. For years, practically nothing has been done with it, but negotiations have been concluded with William Groesbeck and L. R. Martineau of Salt Lake City for the sale of the mine for a sum of $20,000. Part of this sum has already been paid and if it had not been for the financial stringency in the United States, the deal would have been completed before now. It is such a long time since the Emma figured in London finance that its present passing raises not even a sentimental interest.

The shareholders of the El Oro and the Somera companies will meet together in a few days for the purpose of considering an amalgamation. A few months ago it was announced that some scheme would have to be devised so as to adjust the ownership of the veins cut on the 1000-ft. level. One or two propositions have been discussed, and finally it has been decided by the directors to propose an amalgamation. Each shareholder in the Somera Co. is to receive five fully paid shares in the El Oro in exchange for sixteen £1 shares of the Somera. The shares in the latter company are not fully paid, only five shillings per share having been called. It will be remembered that the Somera was floated two years ago by the Exploration Co. as a subsidiary of the El Oro. The natural way of developing the Somera under usual circumstances would have been to make it part of the El Oro property, but the time was not opportune for spending any further profits of the El Oro in capital expenditure for this purpose, because a good deal had already been spent in developing the El Oro itself and providing increased plant; hence the flotation as a separate company. The management and directorate have been identical and the expenses of administration have not been more than if the two mines belonged to one company. The list of shareholders in the two companies contain a good many of the same names. P. L. Foster and R. M. Raymond are in London at present to explain how matters stand, and there will be no difficulty in getting the consent of the shareholders to the amalgamation.

Mexico.

The difficulties of mining companies in want of capital are well exemplified by the case of the Mining Exploration Co., which owns the Choicas and other properties in the Argentine, close to the Chile border. The company was formed seven years ago, but it was not until the early part of 1905 that any active steps were taken to develop the property. The capital was then increased from £100,000 to £175,000 in order to provide working capital. As time went on, additional money was put up, and the issued capital at the present time is £205,000 in shares and £10,000 in debentures. This money has now been spent, and the company owes considerable sums for work done. It has been necessary still further to increase the capital. Owing to the scarcity of money, various schemes proposed by the directors have fallen through. Finally it has been decided, and approved by the shareholders, to issue 205,000 new shares of 5 shillings each and offer them to the shareholders pro-rata to their holdings. This practically

means a voluntary assessment. Evidently there are a number of shareholders who strenuously objected to a forced assessment, so that the proceeds of the present issue will not amount to the full £40,000, unless some of the willing shareholders take up more than their proportional amounts. This mine is an interesting one, for the ore is plentiful and rich, and the reserves are being rapidly increased. A traction engine road is completed, the mineral railway is nearly finished, and the smelter is being erected. I may add that the consulting engineer and technical director is Robert Gilman Brown.

Another copper company that requires more capital to complete its outfit and development is the Messina Transvaal Development Co. This company was formed exactly three years ago by Chaplin, Milne Grenfell & Co. to acquire property at Zoutpansberg in the northern Transvaal. The copper veins have developed in a most satisfactory manner, in many places the vein being solid chalcocite. The lodes have been proved to the 300-ft. level, and they vary from a foot to five feet wide. So far, the character of the ore has not altered in depth. Some idea of the nature of the mine can be gained from the fact that during the year ended June 30 last, 2967 tons of ore were mined, out of which 768 tons were hand-picked, averaging over 60% copper. This was shipped to England and realized £34,626. The remaining 2199 tons averaged 11% copper, and are being stored for treatment in the concentration plant now being erected. Since June 30 the monthly output has continued at about 350 tons, and about 200 tons of ore averaging 60% copper have been shipped every month. J. M. Calderwood, the consulting engineer, estimates that on December 31 the ore ready for stoping was 15,423 tons, of similar character to that already mined. In order to complete the plant, and to develop the mine generally, some further working capital is required. A number of shareholders have agreed to the issue of new debentures.

JOHANNESBURG, TRANSVAAL.

Cost of Mining.—Drills for Stoping.—The Gordon Drill.——Record Output.—Labor Problem.

The mining community is congratulating itself over the fact that the average working costs of the Rand have been brought down to 20s. per ton crushed. In the days before the war one or two mines, like the Glencairn and Langlaagte Estate, where the conditions are favorable, worked for less than a sovereign per ton every month, but never before has the average working cost reached so low a point. Of course, there has been a big drop in the yield per ton, for as the costs come down the tendency is to work more and more of the lower-grade stuff, thus prolonging the life of the mine. In 1899 the grade was about 41s. with working costs in the neighborhood of 27s. per ton. In November last the grade was only 33s., but the working costs were about 20s. During November the profit per ton was as high as in July, August, and September, 1905, when the grade was 36s. The reduction of costs in 1907 compared with 1906 was about 2s. 6d., or 11%. We are still a long way from the 15 to 16s. per ton, which has been placed as the possible figure, but the substantial reduction in 1907 encourages the hope that still further economies will be effected in 1908. The future of Johannesburg, and to a great extent the Transvaal, depends upon the reduction of costs. All practical men now agree that there is a fall in grade as the mines get deeper, and the only way to make the 'deep deeps' possible is to get costs down to 15 to 16s. average.

The winner of the prize offered by *South African Mines* in the recent competition for small drills has been declared to be the Gordon drill. Much has been written in the local press over the success of this machine over the others, and if one were guided by the press solely, the day of deliverance for the Rand is at hand, and the ideal drill has arrived. The public has been very favorably impressed, and the London Stock Exchange has responded, for last week many of the dividend-paying stocks advanced considerably. That the Gordon drill will do good work seems probable, but whether it will revolutionize things is doubtful. The chances are that it will not be so satisfactory on the mines where very narrow stoping widths are imperative. On the West Rand, for instance, where the reef is very narrow, it is possible under favorable circumstances to carry the stopes from 20 to 24 in. when worked with Kaffirs. To make many of these stopes pay this width cannot be exceeded. Now it is doubtful whether the Gordon drill will be able to carry a stope less than 30 in. month after month. The vital question of comparative costs between stoping by hand and with the Gordon drill cannot be answered until more data are available.

The gold output for December constitutes a record for the Transvaal, being 583,526 oz., valued at £2,478,659. This is far and away better than the previous record, made in August last, when 555,027 oz. were turned out. The huge declaration for December is due to the fact that a number of the leading mines, in order to reduce their gold reserves, transferred a large amount from their reserve account. The December output brings the Transvaal yield for 1907 up to 6,451,384 oz., valued at £27,403,738. In December the Rand's contribution to the output was 562,684 oz., the number of mines producing this result being 66. Considering that there were five Sundays and the Christmas holidays, the results for the month are most satisfactory. There were 22 companies producing outputs of 10,000 oz. and over. As usual, the Robinson heads the list, with a declaration of 34,281 oz., valued at £145,616, while the Simmer & Jack came next with 24,798 oz., valued at £105,335.

As regards labor, at the end of December there were 110,337 Kaffirs and 35,676 coolies available for the mines of the Rand. So far the coolies have been successfully replaced by Kaffirs, but there are signs that in a few months time we shall feel the pinch of scarcity as regards native labor. Were an abundant supply of labor assured, the outlook for 1908 would be bright, but the Kaffir supply is so erratic that one never knows what a few months will bring forth. Of course the enthusiasts who never see any breakers ahead, declare that the Gordon drill will to a great extent solve the labor problem, and that the high level of gold production can be maintained, but this remains to be proved. It is to be hoped that 1908 will see an increased activity in the development of the deep levels and the 'deep deeps.' At the present time the Rand is like a clock that is wound up and set going. In eight or ten years time the clock will begin to run down and the glory of the Rand will be passed. It is necessary to get ready some of the deep levels to take the place of the rich mines, which cannot last forever. It is hoped that the improved conditions on the Rand, and the increased dividends being paid to shareholders, will induce a big flow of capital toward the Transvaal in 1908.

The largest wagon in the world has been shipped to Nome, Alaska, for the Pioneer Mining Co. It is over 26 ft. long and 7 ft. high from the axle. The wheels are 10 ft. diam. and are fitted with iron tires 1½ ft. wide.

Concentrates.

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

An electro-magnet has been successfully used in recovering a broken drill from the bottom of a borehole.

The dump of the new tin prospect near Spokane, Washington, is probably the biggest pile of tin ore in the United States. The association of minerals is an unusual one for tin ores and makes this occurrence unique. Although the deposit is irregular and indefinite, there appears to be sufficient ore developed to justify further exploration.

Assessment Work.—In regard to the work needed to be done on an amended mining location, it will depend somewhat upon the conditions existing at the time the amended location is made. If at such time all of the requirements of the law, State, Territorial, and Federal, have been complied with, and the amendment is made solely for the purpose of rectifying boundaries or curing technical defects in the notice, nothing further is required to be done, as in the absence of intervening rights the amended notice relates back to the date of the original, and location work previously done need not be again performed.

Various mechanical contrivances have been tried in southwestern Oregon in the separation of platinum particles from the black sand accumulated during placer mining for gold: the only successful method found is the simple one of panning. The material is panned twice, first for gold and then for platinum, over vats or huge tubs built for the purpose. To save platinum requires considerable care, as the particles are very light and elusive. The Deep Gravel mine in the Waldo district of Josephine county yields from 18 to 25 oz. of pure platinum every season. Probably the total production of southern Oregon mines in 1907 was about 50 ounces.

In most gold-quartz mines, the ore occurs in shoots and patches, frequently with a zone of enrichment by mechanical concentration at the surface, but usually as the vein is followed to great depth the gold contents diminish. This impoverishment is not always quite regular, and sometimes at great depths rich mineral is found. However, the deeper rich bunches in a mine are generally irregular and smaller than those near the surface. In the mines on the Rand in South Africa the fluctuations in value are less violent than in the usual quartz mine and the diminution of gold content in depth is a gradual one. It has become very serious at depths of 4000 ft. Less than 40% of the work done below that level has disclosed profitable ore. The best of the ore from the deeper levels would have been barely profitable in the early days of the field with their high costs and low percentage extraction: the Rand would never have reached its present position on ores similar to those disclosed in the deeper mines of today.

Cassiterite, the usual ore of tin, being an oxide, is not subject to rapid decay under weathering influences such as decompose sulphides; upon the wearing down of a tin lode the grains of cassiterite become disseminated in the soil. On a hillside the material slowly creeps down the slope and the grains of cassiterite gradually work to near the surface of the soil as do the gold grains in the 'traces' followed by prospectors in search of gold 'pockets.' Advantage was taken of this fact in investigating a tin lode in the valley of Lost river on Seward Peninsula, Alaska. Rows of small pits were dug 1 to 2½ ft. deep (at which depth frozen ground was reached), and some of the material was washed in a gold-pan. This process revealed the existence of a distinct 'trace' of cassiterite, which led up to the outcrop of a small shoot of ore already developed by adits; the benefit of the work lay in the fact that the absence of much cassiterite in the soil below the tin-bearing dike elsewhere precluded the probability of other ore-shoots being distributed along the lode and discouraged further expensive and useless development work.

Lead-silver veins usually have a zone of oxidized ore near the surface; at greater depth is the zone of original sulphide ore, which is generally an argentiferous galena. In the oxidation of the galena, the sulphide is first changed to sulphate and then to the carbonate, cerussite. The latter is slightly soluble in the water circulating through the zone of oxidation, and some of the lead salt must be leached out and carried to a deeper portion of the vein or elsewhere, perhaps finding its way into the streams of the district. The silver salts are subject to a similar leaching. However, it is a matter of observation in arid regions such as those of Nevada and Arizona, that while the lead and silver have largely disappeared from outcrops of the vein matter, the strongly leached zone is very thin, often only a few feet deep; profitable lead carbonate ores are generally found to within 5 or 10 ft. of the surface. The wall-rock, whether limestone, slate, or some crystalline igneous rock, can have very little influence on the oxidation and leaching of the materials in the vein, except that as limestone near the surface is generally more cavernous than other formations, it favors the deep penetration of the weathering agencies. In Arizona in a strong vein which cuts Archean gneisses and granites there is such a progressive increase in the mineral contents from the surface to where the sulphide zone appears, at an average depth of several hundred feet, as to suggest leaching near the surface. In this vein, as also in many others, there has been a secondary concentration of the silver salts into bodies of high-grade ore within the oxidation zone. As a general rule it may be said that if a lead-silver vein in the desert region does not contain any profitable ore within 10 ft. of the surface, its chance of developing into a mine at depth is very slight.

Discussion.

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy.

The Plumas-Eureka Mine.

The Editor:

Sir—Your notes under 'General Mining News' concerning Plumas county, California, in the current issue (Feb. 1) are somewhat misleading, and as the Plumas-Eureka mine has played no small part in the history of gold mining in northern California, its mining and milling costs being quoted in several standard text-books, I thought perhaps people who knew the old mine in its palmy days, would be interested to know what steps are being taken to place it once again upon the list of gold-producing properties.

The mine was purchased by its present owners, the Johnston Graham Mining Co., in the spring of 1905, but very little was done toward re-opening the property until the summer of 1905. After a careful examination and sampling of those parts of the property it was possible to reach, it was decided that the easiest point of attack and the one most likely to yield quick returns was the Seventy Six mine. The Hosking cross-cut, the lowest opening into the Seventy Six workings, was cleaned out and an aerial tramway by the Broderick & Baseom Rope Co. installed, connecting the mine with the mill-building, a distance of about 1000 ft. vertically and 3400 ft. on the incline below. The old mill-building, which was in a state of great dilapidation, was renovated and a new 20-stamp mill of 1000-lb. stamps furnished by the Fulton Iron Works was erected. The Jamison flume, four miles long, has been rebuilt for the greater part of its length, and the remainder roughly repaired. A commodious boarding-house has been erected on the banks of Eureka lake for the miners.

The work in the mine has been confined entirely to development. This policy will be necessary for some time, as prior to the present company taking hold, the mine had been let on a series of short leases to tributers, apparently without any restriction; and they had naturally taken every particle of available ore that would pay for transportation to the mill down the old tortuous series of inclined and horizontal tramways. Development work has been confined for the present to three veins, the South vein underlying the Balten tunnel vein in a southerly direction and the Balten tunnel cross-cut vein, and an overlay of the same, in a northerly direction. All work is being prosecuted from the level of the Hosking cross-cut.

Five stamps were started in November of last year, and five more in the middle of December, since then 10 stamps have been dropping continually, from ore taken out in the process of development. With the exception of a few promotion shares owned by Western people, who were instrumental in bringing about the sale of the property, the mine is owned by Newport (Rhode Island) people, who have found the money for the construction and development work, without seeking any newspaper notoriety. Just after the purchase of the property an article appeared in a San Francisco paper, written by someone whose enthusiasm was considerably in excess of his knowledge of either the mine or the science of mining; with this exception, so far as I am aware, no boom articles have been written about the property nor are any required.

In conclusion I may add that the note with regard to the Little Jamison mill should read the Jamison mill, which, after being temporarily closed down on account of shortage of water, is again running. G. S. Redstreak is superintendent and S. W. Cheyney the consulting engineer.

F. H. MASON.

Johnsville, California, February 4.

Prospecting With the Diamond-Drill.

The Editor:

Sir—For those undertaking core-drill prospecting, the following examples may be of interest in showing some of the errors to expect, especially where results are confined to one hole.

In using drills one cannot be too careful, both in laying out the work and in sampling both core and sludge. Some years ago in one of the old camps a drill-hole was put down in ground supposed to be on the continuation of a very large ore-shoot, the writer having the contract for the work. At a depth of about 500 ft. a contact was encountered and immediately under it there was ore. According to the drill results, 10 ft. of ore was in the hole. The ground was soft and made little core, and that in small pieces. In passing these 10 ft. of ore, samples were taken of both sludge and core every 2 ft., all the core obtained being ore. At the same time underground waters were carrying away most of the sludge, there coming to the surface about an equal amount of it as of the core, the resulting sample being small. The whole 10 ft. drilled the same way, no change being noted in the working of the bit in the hole. On the information given by this hole, a shaft was sunk at a large expense, much water being encountered. When the ore was reached it was found to be in small seams throughout the lower 10 ft. of the contact, but not in paying quantity. The expense of sinking this shaft was borne by intelligent and successful mining men, who went into the scheme with the utmost assurance of success. In the shaft the seams of ore were found to be slightly harder than the enclosing rock, which accounts for only ore being in the core. Another source of error is when using a drill for cross-cutting for veins. In places where the country rock carries seams and stringers, if the vein happens to be cut in a tight narrow place, it is impossible to tell which is the vein. This is also true of a drift in a mine, but in that case one can generally see some distinguishing signs of the vein looked for. In cutting a vein it is often the case that the drill will not determine the actual width, as vugs or irregularities in the walls cause the operator to think that the bit is still in the vein. Ground rarely gives all core, the pieces grinding against each other in the core-barrel causing a partial loss of the core. There is no way of getting at

the exact width of a vein except by the action of the drill when working. These are all cases seen by the writer that have caused losses, and when there are so many sources of error in using drills, every precaution possible should be used in order to get accurate results.

R. B. WEDDLE.

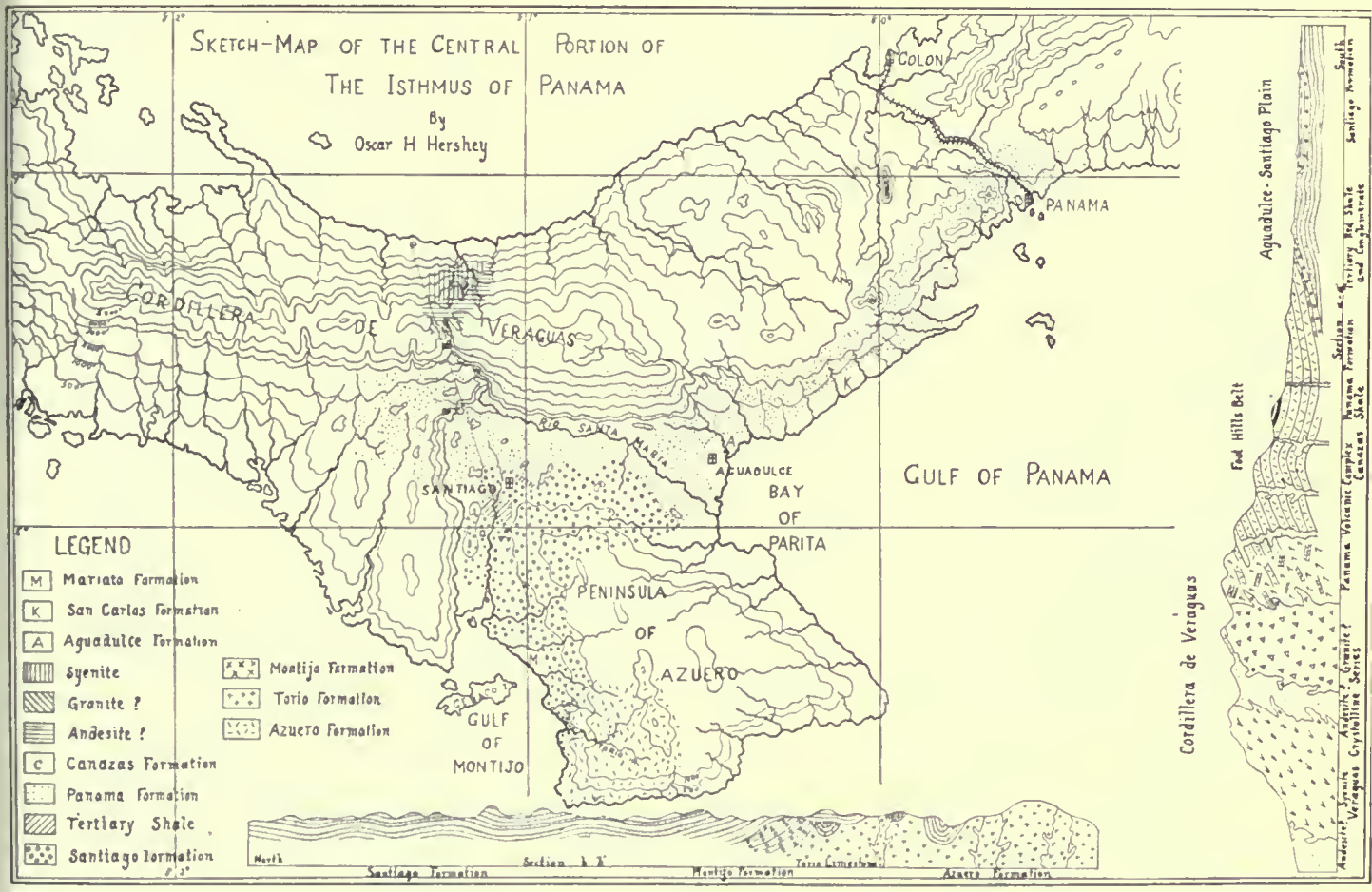
Dehesa, California, January 25.

Mining in Panama.

The Editor:

Sir—The geology of the central portion of the Republic of Panama is much more complex than it has been described by Mr. Scott Turner in your issue of January 25. Andesite probably plays a relatively unimportant rôle in it. I have discussed at considerable length the geology of the districts about Aguadulce, Santiago, and Cañazas, in No. 8, Vol. 2, Bulletin of the Department of Geology of the University of California. Aguadulce is situated on a Pleistocene sedimentary formation and Santiago is near the northern border of a much older sedimentary series. The village of Cañazas and the Remanse mine are in the midst of a broad belt of the Panama series of volcanic rocks. In the southern half of the belt the Panama formation is chiefly water-laid rhyolitic and trachytic tuffs intruded by plugs, dikes, sills, and laccolites of diorite, andesite, basic porphyries, and basalt. North of Cañazas and the Remanse mine the basic intrusives make up a large part of the entire formation and the volcanic rocks in general display much less evidence of water deposition. However, a small area of sedimentary rocks occurs within several miles east of Cañazas. The high jungle-covered range of the Cordillera de Veraguas lying north of the volcanic belt is composed largely of plutonic rocks, including an alkaline granite and a syenite; these may have been intruded into a finer-grained dark gray rock that has been doubtfully identified as andesite.

Probably the most promising undeveloped district in the Veraguas country lies within the area of plutonic rocks on the northern side of the Cordillera de Veraguas. It is known as the Mineral Veraguas district and includes the old drift mines of Cocuya, gold from which has been the basis of several Colombian fortunes. It was discovered over



350 years ago and mining prosecuted in it, first by the Spaniards and Indians and later by the Colombians until about 24 years ago when it was finally abandoned by the last inhabitants, Angelo George, an Italian, and his Indian helper. This was not because it was worked out, but on account of the severe conditions. It was situated in an almost impenetrable jungle and in a region where rain falls on nearly every day in the year. At the time of my visit in 1898 the old workings were obscured by the dense growth of vegetation, but I was fortunate in having the services of Angelo George as guide. Two small veins of gold-bearing quartz had been accidentally discovered in the course of placer mining and a French company once made an attempt to work them. I found the ruins of a 16-stamp mill and two arrastres; also a pile of quartz that yielded well in panning. However, the one vein that I found was very small and I concluded the operation had been ill advised. A favorable impression was made

by the great number of rough fine grains of gold that I could save in the gold-pan from the gravel and sand along the Santiago river. As I was fresh from panning the gravels of many California rivers and creeks, I had a good basis for comparison. The gold grains were identical in character with those I had often panned from the outcrop of gold-quartz veins in California. They were so abundant that I was convinced that only a small part of them had been derived through the decomposition of the few small veins that had been discovered. The half-mile of steep mountain gulch between the head of the Santiago river and the highest point at which I panned is the most promising place I know in which to apply the Californian method of searching for gold-quartz veins by the aid of 'traces' of gold in the dirt. The Spaniards, Colombians, and Indians knew nothing of this method. At one place, half-way up the slope of a mountain, they worked the soil over several acres for the fine-grained gold they could get from it. The pits and mounds remaining terminate on the upper side of a comparatively straight line; perhaps a valuable vein is buried under the soil not far above this line. I do not make these statements with the object of attracting prospectors to that locality, for they would be helpless in coping with the jungle. Further, the average mining engineer would be unfavorably impressed, for the country has returned practically to its primeval condition and there are no mines to see. It is also true that the gold in the placers may have come from innumerable seams instead of a group of large veins. Similar fine-grained gold is abundant along other streams of the region, particularly the Bijuco river.

Mr. Turner is keenly appreciative of the difficulties encountered by mining companies that attempted to operate in the comparatively dry region south of the great range, in their poor management, and in their almost invariable failure.

OSCAR H. HERSHEY.

Berkeley, January 27.

Cyanide Methods.

The Editor:

Sir—In your very courteous and most appreciative editorial of January 4 you refer to me as being interested in the manufacture of the Ridgway filter and therefore (?) pardonably partial to it. I am interested in the Ridgway filter, as I am in the Merton roaster, the Dehne filter-press, the Davidsen tube-mill, and other valued appliances for improving extraction. Indeed, such an interest is not merely desirable from a pecuniary point of view but is necessary to me for the securing of absolutely reliable data and for following up the results of different appliances under differing conditions. But you appear to misinterpret cause and effect. My interest in the Ridgway is the result of my appreciation of it, and not vice versa. Thus it will be news to you that my interests in the two other methods recently prominently discussed in your columns is probably much greater than in the Ridgway. I do not own the Ridgway patents, but I do own the patent in America for the filter-frame which has probably treated a greater tonnage by the immersed basket-filter method (Moore process?) than have the Liberty Bell and all the other mines (using this process) in America put together. Again, I also own the Thompson (1899 Transvaal) and other patents for fixed immersed suction or pressure basket-filters. These patents appear to me to be the master patents of the majority of the devices now on the market; but my ownership of these patents does not blind me to an appreciation of the Ridgway filter any more than did my interest in Dehne filter-presses, to which the Ridgway machine is in opposition.

ALFRED JAMES.

London, January 30.

Cyanidation in Nevada.

The Editor:

Sir—The discussion started by Mr. Browne has borne good fruit in that it has elicited the able and comprehensive article by Mr. King appearing in your issue of January 25. The method of treatment of Goldfield ore advocated by Mr. King is not in any sense experimental and has proved to be best in West Australia, where the conditions as to high cost of power, water, and fuel were similar to what they now are at Goldfield. The same method is in use at the Golden Cycle mill, where they treat Cripple Creek ores. This mill is a custom plant depending on the extraction and economy of treatment for its profits, and works ores for a freight and treatment charge of $4, of which $1 is freight. At Mercur they mine and mill their ore for a few cents over $3 per ton. The tests made by Mr. King, the results of which are given in his article, prove that Goldfield ores are perfectly suited to this method of treatment and it is difficult to understand what objections can be held against it.

It is reasonable to state that the best method is that which extracts the gold in one treatment and with the simplest machinery. The mills in Nevada, however, seem to be designed to extract the gold and silver in as many forms as possible and each one may be said to be an epitome of the history of ore treatment. Amalgamation followed by concentration and then by cyanidation represents the order in which these processes came into use and is the order in which they are used in the mills.

Regarding amalgamation, Mr. King's results show an extraction of only 4.2% by amalgamation on the raw sulphide ore. On the roasted ore the extraction by amalgamation was 44.67% and subsequent concentration and cyanidation brought up the total extraction to 97.17% at 30 mesh. Direct cyanide treatment at the same mesh yielded the same extraction. His further results at 100 to 150 mesh show that the gold in the roasted ore is quickly and completely dissolved by cyanide. These results tend to prove that, contrary to the general belief, roasting does not cause the gold to become coarse or run into beads when the telluride is decomposed. Gold telluride melts at a low temperature, below a red heat, and when a rich specimen of telluride ore is roasted, the melted telluride runs out on the surface and the tel-

lurium is oxidized, metallic gold being left. This gold looks exactly as if it had been melted, but on examination it is found to be porous or spongy. I once took a piece of this porous gold resulting from the roasting of a rich specimen of Cripple Creek ore and placed it in an ordinary 1% cyanide solution and found that 70% of it was dissolved in a couple of days. However, as Mr. King has shown, in the case of a rebellious ore that actually did contain coarse gold, grinding the roasted ore to 100 mesh resulted in a practically complete extraction of the gold by cyanide; the presence of some coarse gold is a matter of no importance when fine-grinding is done. My answer to the question of 'Viator' regarding the treatment of ore carrying coarse gold as well as fine gold is, therefore, that, when fine-grinding is done, the coarse gold will be ground fine along with the gangue and dissolved in the cyanide without any difficulty. Owing to the great cheapening of the cost of fine-grinding by the use of tube-mills and the improvement in the filtering and washing of the fine pulp by modern filter-machines, fine-grinding will be used in the majority of mills. Amalgamation will be unnecessary and only a needless expense. In the few instances in which it may be better to extract the coarse gold by amalgamation, amalgamation should follow cyanidation and the processes should be kept separate.

As regards the roasting of ore in localities where fuel is expensive, some means should be adopted to reduce the cost of the fuel. When it is remembered that the roasted ore is discharged from the furnace at a temperature approaching 800° C, it is obvious that if a fair proportion of that heat could be returned to the furnace, an economy in fuel would be effected. In all cases the hot roasted ore passes through some cooling device, but it is generally some water-jacketed arrangement, and the heat abstracted from the ore is lost. It would seem to me that a simple heat-exchange device could be used by means of which the ingoing air could take up a portion of the heat from the outgoing roasted ore and so return it to the furnace. By extending the hearth a sufficient distance beyond the finishing hearth and by keeping the arch as low as possible, the air entering the furnace at the discharge end will abstract the heat from the hot roasted ore. The economy effected by the return of this heat to the furnace will amount to about 25%, but there is the additional advantage of using pre-heated air for the combustion of the fuel. In a modern lime-kiln where the air is pre-heated by means similar to the above, an economy of 30 to 35% has been attained.

It has been the practice in chlorination works for a number of years to crush only to 10 or 12 mesh before roasting and to grind as fine as required after. This is, for many reasons, the best practice and I think the principle should be further extended. Preliminary tests should be made to determine how coarse the ore could be left compatible with getting a 'sweet' roast in a reasonable time. In the majority of instances this will be found to be much coarser than is generally supposed and possibly a quarter-inch size will be found fine enough. Drying of the ore would only be necessary in exceptional cases and the crushing could be done cheaply by jaw-crushers. As roasted ore is much more friable than raw ore, this would mean a big reduction in the total cost of crushing and grinding. The decrease in the tonnage to be ground for the same output of bullion (owing to the loss of weight in roasting), the greater friability of the roasted ore, and the advantage in filtering of having a pulp free from hydrated silicates should be credited to roasting and the saving effected deducted from the cost of roasting as compared with the treatment of the raw ore.

With the greatly increased use of fine grinding during the last few years the filtration of the pulp has become a question of increased importance and has brought forth a large number of filter-machines, all of them using canvas as the filtering substance. As referred to by Mr. King, the incrustation of carbonate of lime on the canvas is a great drawback, and I am reliably informed that at the plant of Mr. Charles Butters at Virginia City, two men are employed all the time to take out the filter-leaves, treat them with acid, and return them. To the majority of people a sand-filter consists of, first, a layer of coarse gravel, then one of fine gravel, then one of finer gravel, and then one of sand, in all about a foot or so thick. The impression is also general that fine slime will pass through a layer of sand. The fact is that a layer of clean sand an inch thick will, if properly supported, form an efficient filter for the finest slime. I first used the triangular-slat-sand filter in 1888 for the drainage of sewage sludge. In 1894 these filters were put in the plant treating tailing from the Vulture mill at Wickenburg, Arizona. They remained in constant use for about two years and were cleaned not once during that time. One advantage of a sand-filter is that the filtering material is always on hand at the mill. When canvas is used a large stock has to be kept on hand and much inconvenience may result from the delay of an expected shipment.

Mr. King's article is especially valuable in that it gives the results of original work carefully and systematically performed, and it is to be hoped that others will publish results that they have obtained to the improvement of this branch of metallurgy.

BERTRAM HUNT.

San Francisco, February 5.

The Editor:

Sir—Referring to Mr. Lochiel M. King's article on this subject in your issue of January 25, I do not doubt the presence of tellurium in small quantity in the high-grade ore from the Mohawk mine of the Goldfield Con. Mines Co. In fact, I stated as much in my communication (issue of January 11). I still maintain, however, that there is not enough tellurium present in the milling ore now exposed in Goldfield (in the properties of the Goldfield Con. Mines Co.) to interfere with milling treatment by wet methods; and that the tellurium found in the higher-grade ore from the Mohawk mine is not in sufficient quantity to justify roasting in a large mill designed

to treat milling ores from all of the Consolidated properties.

EDGAR A. COLLINS.

Tonopah, Nevada, February 6.

National Mining Bureau.

The Editor:

Sir—In the issue of the MINING AND SCIENTIFIC PRESS of February 1, I note that you have placed before your readers a part of the letter addressed by me to the Secretary of the Interior on the subject of more extensive recognition of the mining industry by government investigation. In my letter of January 18, enclosing a copy of the letter to the Secretary, I authorized you to use any portions of it, and added that "after working for twenty-eight years in the interest of the mining industry the Survey will not, of course, oppose what may seem for the good of that industry." That is the point of the letter, and the position taken by the Survey is clearly outlined in the last paragraphs. I am very sorry to see that you have omitted them. The Survey earnestly wishes to place itself on record before the mining men of the United States as to its recommendations in this case. As the letter is printed in your paper of February 1, considerable uncertainty must be felt by the reader as to the actual proposals made. This is much to be regretted, as special care was taken to make this matter perfectly clear in these closing paragraphs. I think that as long as the remainder of the letter has been printed it would be only fair to ask that you should state the position of the Survey by publishing the last part of the letter.

GEO. OTIS SMITH.

Washington, February 8.

[This letter from the Director of the Geological Survey was received just as we were going to press last week. His request had been largely anticipated by an editorial statement in regard to the attitude of the officers of the Survey and a brief quotation from Mr. Smith's letter.—EDITOR.]

Closing paragraphs of letter from the Director to the Secretary:

"To meet the actual needs of the industry, the time is opportune for the enactment of well considered legislation and I submit herewith the draft of a resolution which in the opinion of myself and associates in the Survey is adapted to accomplish the desired end. My purpose is to suggest legislation that will adequately provide for an increase in the mining work by the Federal government without duplicating that already authorized. Some plans already presented for a Bureau of Mines have contemplated taking over much or nearly all the work of the Geological Survey; others have confined the proposed Mining Bureau's activities to the more purely technologic problems together with the statistical work.

"It appears to me that there is only one true line of cleavage between these subjects, and this lies between the pure technology and those matters relating to the distribution, occurrence, origin, and production of mineral deposits. Those who advocate the turning over to another organization the statistical work of the Survey have little comprehension of the true character of these investigations. As now carried on, this work embraces not only the tabulating of the statistical information, but also the discussion of the source of the materials themselves.

"On the basis of the historic development and present status of Federal work in aid of the mining industry of the United States, the limitation of the function of any organization independent of the Survey to strictly technologic work is in my opinion absolutely essential if duplication of work and rivalry are to be avoided. To the same end I wish to place great emphasis upon the importance of having the name of the organization such as to express its functions and those alone. The word 'mining' in itself would be inappropriate for investigations which form a part only of those relating to mines and mining. With this in mind I submit herewith a draft of a joint resolution providing for the establishment of a Mining Technology Branch in the Geological Survey, the passage of which would constitute a decided gain in the expansion of the mining investigation by the Federal government.

"If, however, in the opinion of Congress, conditions are favorable for the realization of the proposition for an independent organization, it is my belief that the bill establishing such a bureau should provide not for a bureau of mining, but for a Bureau of Mining Technology. I therefore submit the draft of a bill which provides for the establishment of an independent bureau to which the work now under the Technologic Branch of the Geological Survey could be transferred. Such a bureau would supplement along purely technologic lines the geologic work of the Survey in behalf of the mining industry.

"In the event of the passage of the joint resolution first mentioned, my endeavor would be to so administer the added work as to promote the possibility of its ultimate establishment as an independent bureau whenever found advisable, while if the bill for the creation of a separate bureau should be enacted, the Geological Survey would co-operate with the Bureau of Mining Technology under your direction."

A Correction.

The Editor:

Sir—In the article describing the electrical hoisting equipment of the Kendall Gold Mining Co. of Kendall, Mont., and appearing in your issue of January 11, you have given credit to the General Electric Co. for the entire equipment.

We desire to inform you that the double-drum hoist used in this installation was built by us for the mining company mentioned. The electrical equipment was furnished by the General Electric Co. As this installation at Kendall is the latest improvement in hoisting equipment, and is also the first of its kind installed in the United States, we naturally desire to have credit for our share in it.

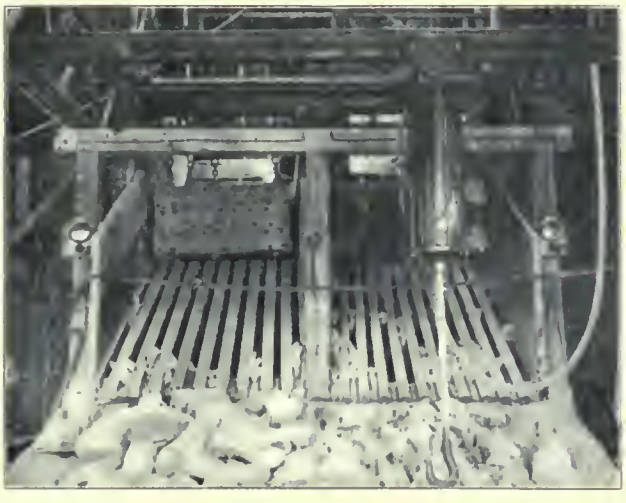
THE DENVER ENGINEERING WORKS CO.,
LEWIS SEARING, General Manager.

Denver, January 30.

LAKE SUPERIOR ORE-DRESSING PRACTICE.

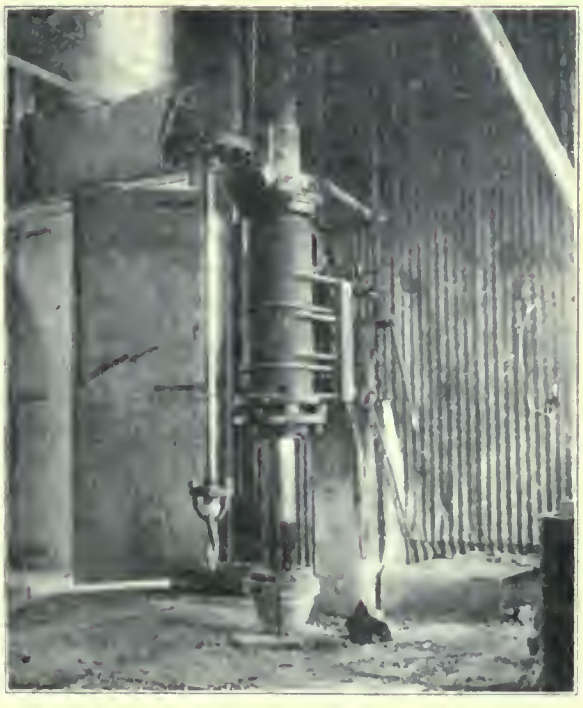
Written for the MINING AND SCIENTIFIC PRESS
By L. S. AUSTIN.

Steam-Stamps.—The tendency during the past year has been toward the increased use of the compound head, because of its economy in steam or the horsepower per ton of the ore stamped. While this is true, there is less increase in the use of the



Grizzly at Trimountain No. 4 Shaft.

type than was at first anticipated. There are critics who think that the drawbacks, due to the larger quantity of oil and waste needed, the additional supplies for repairs, the repairs account itself, and



Air-Lift and Hammer.

the delays caused both by repairs and by breakdowns, more than compensate for the economy in steam. The labor item is also greater, since a head-runner is needed for each head, while with simple heads one man can attend to three. To retain the feature of simplicity, the Quincy mill has put in a 24-in. simple cylinder in place of the usual 20-in., has dispensed with rolls for re-grinding the oversize from the trommels, and has increased the capacity of the head to 700 tons in 24 hours. At the Calumet & Hecla mill they have added no others to the first compound head erected. On the other hand, the new installation of the Champion mill includes compound heads, and they have added three at the Centennial mill at Rouse's Point, thus doubling the original equipment of three heads.

45-lb. Ingots of Copper.

Rolls.—The favorite style seems to be the springless rolls, though at the Champion spring rolls have been placed, having a contrivance for parallel opening. Where springless rolls are used, a grating in the feed-chute excludes any possible bolts, pick-points, or hammer heads. The feed contains nothing larger than $\frac{5}{8}$-in. diam., so that, even when these pieces are of copper, they are readily flattened, screened out, and removed by the bull or roughing jig. The wooden key was at first inserted for the

Mass Copper at Champion Mine.

main driving pully to prevent stalling the rolls, but, since it was too readily sheared with a suddenly increased load, it has been replaced by an iron key, risking thus the remote chance of stalling or breaking. The rolls are estimated to relieve the stamps to the extent of 200 tons daily in their duty of crushing the oversize of $\frac{3}{4}$ in. from the trommels,

the undersize going to the main system (or 'wash') of the mill.

Re-crushing Middling.—Of the two kinds of mills, the Huntington and the Chilean, both of which have been tried here, the latter has been adopted at the Calumet & Hecla in the new re-grinding plant. The claim has been made that its action, which is a twisting, as well as a direct-rolling, is not an objection in the treatment of the conglomerate rock where sliming does not hurt. As is well known, the copper in this ore is so closely knit that fine grinding gives the best results, even when accompanied by some sliming. No attempt has been made to use the tube-mill in Lake Superior practice, though we have an example of one in the district, used however for the grinding of sand in making lime-brick. Considering the cheapness of the wearing surfaces in the tube-mill, it would appear that it could be adopted with a great saving for repairs and for castings.

Jigs.—The Woodbury jig is coming increasingly into use, and is being put in at the Champion after having been thoroughly tried in the Calumet & Hecla mill. Arranged as a series-jig it has large capacity, acts as a screening system, and separates out an overflow for classification.

Classifiers.—The roll product is conducted to single compartment classifiers, having a pyramidal bottom, and using hydraulic water. The overflow goes to tables, the spigot-discharge to jigs. The hutch-product from these jigs goes to finishing jigs. On the whole, classifiers in Lake Superior practice are imperfect, and would not be tolerated except in treating an ore where there is so great difference in specific gravity between the concentrate and the gangue. The four-spigot Tamarack classifier is imperfect in that any given spigot-discharge is contaminated with coarser and finer grains properly belonging to other spigots or to the overflow. The first spigot is also apt to discharge most of the jig-stuff, leaving but little for the later jigs to treat.

Tables.—The Wilfley concentrating table holds its own, and the more so as its use has become familiar. It, or some equivalent table of the same type, is used for concentrating Evans-table heading so as to obtain a high-grade product.

Schwartz has devised a roughened or grooved sheet-lead covering for the Wilfley table. These grooves are shallow, 20 to the inch, and run parallel to the long sides of the table. They assist in the elimination of the finer gangue, and in bringing the fine concentrate under their shelter to the discharge end of the table. It has been found that the grooves are disposed to fill up and coat over, and it is proposed to overcome the defect by copper-plating the surface.

Companies in the copper country have been willing to expend money in experimenting with apparatus, and in introducing improvements, often at great expense. Their methods of ore-dressing have often been criticized, but it must not be forgotten that with such low-grade ore, of which large tonnages must be handled, they are unwilling to supercede methods that have done good work in favor of new but untried plans, no matter how good in principle. An example of such liberality may be given in the case of the Champion mill, where a graded-crushing system, involving the use of rolls, was tried for an entire year. It was hoped to make an economy in power, and especially to effect a closer saving than in the old way. However, the greater complication of the system, and the equal losses in tailing, resulted in a decision to tear out this equipment and replace it with stamps. At this mill the present plan is to use thoroughly constructed compound stamps in connection with Woodbury jigs, large settling-tanks with goose-neck spigot-discharge and Deister tables.

The Alpha Shaft Accident.—Three miners were entombed on Dec. 4, 1907, in the Alpha shaft of The Giroux Consolidated Mines Co. in the heart of the low-grade copper deposits near Ely, White Pine county, Nevada; on the evening of Jan. 18 they were rescued after 45 days imprisonment 1000 ft. below the surface. Four men were working on the morning of Dec. 4 at the bottom of the 1085-ft. shaft and the pumpman was at the pump-station on the 1000-ft. level. When the cave started the men attempted to gain the upper level by climbing the ladders through a shower of timber, rocks and earth that fell about them. Two were knocked back and killed, but two reached the pump-station safely. While the shaft was caving, the pressure in the steam pipes was flowing the station full of fine dust; the pumpman telephoned the engineer in the shaft-house to shut off the steam pressure and immediately afterward telephonic communication was interrupted. Later, at the direction of the mine electrician, the instruments were connected to the power cables running to the electric pumps, and thus telephonic service was restored. In the meantime a 6-in. water-pipe was used as a speaking tube. The imprisoned men took a gate-valve and several feet of pipe off this line, allowing food, water, candles and reading matter to be lowered and received. The mine master mechanic devised a train of 12 carriers made from 2-in. pipe nipples and caps, connected together with eyebolts and flexible connections. The 6-in. pipe when not in service for lowering food, water, etc., was used for the air supply; an attempt to furnish compressed air through the steam-pipes merely blew dust into the station, owing to a break in the line. The imprisoned men did not suffer much from cold, but the dust and dampness produced discomfort. They kept the drift well lighted with candles and were able to take exercise by walking back and forth in it. During 46 days the work of rescue was pushed as rapidly as possible. A considerable portion of the shaft was found so filled by a rammed mass of timbers, rocks and earth that clearing was difficult. Finally an open space was found leading from near the 700-ft. level to within 30 ft. of the imprisoned men; the material below this opening was largely fine dust, and the men aided in their rescue by letting this dust run into the drift and shoveling it back.

A THEORY OF ORE-DEPOSITION.

Contributed to the MINING AND SCIENTIFIC PRESS
By J. E. SPURR.

*It is the correct procedure in scientific literature to present evidence in detail, and then the conclusions to which, in the mind of the writer, that evidence has led. In the present instance, I should like to be granted an indulgence, and present, baldly and in the barest outline, a theory or series of theories, leaving the presentation of the progressively built steps of evidence till a later time. It should be stated, however, that the ideas as stated are not imaginative, except in the logically legitimate sense: they represent the total inductive results of the writer's experience, pieced together so as to form a working hypothesis.

This paper has been written hurriedly in the field, under stress of work, without notes or references of any kind; and allowance should be made for the absence of citations from the writings of others.

Portions at least, if not all, of the solid crust of the earth are underlain by fluid and uncrystallized rock magmas. These magmas represent, prevailingly or entirely, what are known to petrographers as intermediate types. They differ, however, in different sub-crustal regions. These differences, expressed by certain ratios of the relatively common rock-making elements, have given rise to the recognition of petrographic provinces. More delicately and unmistakably (as in all classifications) the differences are expressed by differing amounts and ratios of the less common elements, among which are to be reckoned most of the metals; and these differences have led to the recognition of metallographic provinces, a conception of especial importance to the economic geologist, whose investigating problems bear chiefly upon the distribution of the metals in nature. The origin of these differences in uncrystallized and uncrystallizing rock magmas is unknown.

By intrusion, or erosion of overlying rocks, or both, portions of these intermediate magmas are (at apparently irregular intervals and on account of obscure events) brought within the zone of incipient crystallization. Crystallization commences, minerals being deposited in an orderly succession dependent upon the chemico-physical laws of magmas (which differ from those of dry melts). Roughly speaking, iron, lime, and magnesian silicates are first precipitated, then silicates of the alkalis, and, finally, the residual silica.

In the lower part of the zone of crystallization, this process of consolidation extends over a vast period of time. Meantime forces (largely physical) are at work tending to concentrate like and similar minerals. Such cooling magmas must be subject to oscillations and currents due to crustal movements and changes of pressure and temperature; to convection and to specific gravity. These currents tend to 'classify' the magma (to borrow an illuminating technical term from the science of ore-dressing) according to the specific gravity and size of the crystallized minerals, and the specific gravity of the residual fluid magma. By specific gravity, also, similar minerals and minerals of similar weights, become concentrated in still magmas.

In such solidifying magmas, currents set in motion at any stage of the crystallization may drain off the residual fluid, leaving the already formed crystals massed together to make up the greater part of the solid rock; or often a different (chemically) residual fluid may be substituted, from whose crystallization the final rock fabric is completed. The evidence of this last-described condition is found in certain of the phenomena of magmatic resorption, where earlier-formed crystals find themselves, through accidents like those above suggested, in a changed mother liquor in which they are unstable and are partly or entirely dissolved.

It follows that the residual fluid magma, drained off from the crystallized portion, at any stage of crystallization, may preserve its identity till its own crystallization period arrives, or may in turn, on partial crystallization, undergo the subtraction of the still fluid portion; so that rocks representing all the stages of crystallization, as well as others representing many different combinations, result.

Through this long and intricate period of orderly crystallization, and orderly sorting, it results that the rocks solidified from a single magma are of many different kinds, mineralogically and chemically; that phases are common where the minerals represent the first stage of consolidation only, or the last stage of consolidation only; that rarer but still frequent phases are found where the rock is principally composed of a single mineral; and that, obscuring the evidence of these clean products of concentration processes, apparently anomalous rock-types occur, in which usually unsociable minerals are associated, such types representing in many cases, probably, physical mixtures of partially concentrated sub-magmas. That concentration of like or sociable (for chemical or physical reasons) minerals, actually takes place in many magmas, in deep-lying zones now revealed, by erosion, at the surface, is recognized by geologists; the unmistakable evidence of it can be read in outcrops in numerous localities; and in some cases it can be proved that the secret of this rock differentiation lies in the slow successive crystallization, the draining off and migration of the successively residual fluid, and the consequent massing of the crystallized portions.

According to this hypothesis, the normal succession of sub-magmas, emitted from a solidifying magma reservoir and consolidating as intrusive or extrusive rocks, should represent a progressive change from less silicious to more silicious rocks; or, as it has usually been stated, from basic to acid. This is actually the succession recorded for certain igneous centres by some of the best geologists; and it is the history to be read on many exposures of originally deep-seated granular igneous rocks. If, however, the heat and pressure conditions, instead of remaining uniform, were fluctuating, then in the reservoir of consolidating magma rocks would, after partial or even entire consolidation, be reduced to a

*From advance copy of a paper to appear in *Economic Geology*.

liquid condition; and this would happen many times in succession. With each wave of increased heat the mass of segregated (differentiated) crystallized, semi-crystallized, and still fluid materials in the magma reservoir would be transformed into a complex of differing magmas, and in each magma phase with each downward swing of the temperature the process of further segregation by progressive crystallization, accompanied by mechanical and chemical concentration would continue, bringing about more perfect differentiation. Thus materials emitted from time to time from such a reservoir would show a progressive change from the original intermediate magma, to more silicious and less silicious magmas; and this is actually the observed succession of both intrusive and extrusive rocks near many igneous centres.

The above hypothesis assumes that rock magmas do not begin to differentiate until they are subjected to unusual or catastrophic conditions;† that these conditions are supplied in magmas which occupy the lower portion of the zone of crystallization, where consolidation is very slow and may be interrupted by fluctuations of heat and pressure; and that under such conditions, from an intermediate magma, rocks and rock magmas varying from very silicious to very basic may originate.

It has been stated that in the succession of crystallization, as a rule, minerals high in magnesia, lime, and iron are precipitated first; and those high in silica (and the alkalies) afterward, residual silica in the form of quartz being practically the last of the abundant rock-materials to solidify. This is the reverse of the laws of dry melts, such as are obtained in smelters; and this difference is due to the fact that the magmas are not dry melts, but contain water and certain elements which under surface conditions are highly volatile, such as chlorine, flourine, and the like; and which, even in the magma, are probably highly mobile. The laws of crystallization in such a mixture are chiefly known to us by inductive reasoning from the phenomena observed by field and microscopic study of the igneous rocks.

The following consideration must be borne in mind in studying all igneous rocks; the common distinction between 'igneous' and 'aqueo-igneous' fusion (made in passing from granites to pegmatites, for example) is certainly wrong. Granite cannot be crystallized from a dry melt; and the transition between granitic rocks and successively more and more basic ones is gentle, showing a gradual change of conditions and the constant though decreasing difference (with increasing basicity) between the igneous rocks and those mixtures that can be obtained by crystallizing dry melts of the same chemical composition. The gradually changing conditions of crystallization that are to be reasoned out for the igneous rocks, from the most basic to the granites and alaskites, do not represent differences in kind, but of degree. They appear to depend upon the fact that water and the other highly mobile elements of the magma are among the constituents which are most difficult of crystallization; hence with progressive consolidation of the magma, more and more of these elements are left over and enter to a larger and larger degree into the composition of the uncrystallized, growingly silicious magmas; and become more and more important in comparison with heat in controlling the fluidity and mobility of these magmas. Yet heat always remains an important factor, both in the rocks commonly recognized as igneous and in the complex series of mineral aggregates (mineral veins) resulting from precipitation from solution in a highly aqueous vehicle, which aggregates I shall presently define as in some sense igneous phenomena; and does not cease to be so till the dissolving water is crystallized at the surface, as ice, an extreme but perfectly logical conception which will readily be apprehended when it is remembered that water is fused (or melted) ice.

The above conceptions involve the idea that a magma is a fluid mixture, restrained from crystallizing into an aggregate of minerals by heat, but which crystallizes out on reduction of heat at a point largely dependent upon the chemical composition of the mixture and especially upon the content of water and certain other highly mobile elements; that in a cooling magma of the composition of what are ordinarily known as igneous rocks the less silicious minerals are first deposited, and the residue becomes more and more silicious, affording on crystallization more and more silicious rocks; and that with this change, and as the temperature diminishes, the residue becomes more and more aqueous, and more highly charged with the other mobile elements.

The crystallization of these successive magmas into minerals or mineral aggregates is represented by a well-known series of rocks from pyroxenites through peridotites, gabbros, diorites, granites, and alaskites: and as at the more basic end I have instanced pyroxenite, a rock composed essentially of a single common rock-making mineral, which is among those first crystallized out of magmas, and which on addition to feldspar becomes, for example, gabbro; so at the other end come certain rocks composed essentially of quartz, the last of the rock-making minerals to be crystallized in abundance out of magmas, and which on addition of feldspar becomes, for example, alaskite. This quartz deposition, as I shall point out, has many stages; but the first period of the pure quartz rock is that where it is still associated with and intercrystallized with small amounts of other rock-making minerals well known as characteristic of the alaskites and the granites, such as alkali feldspar and muscovite. This stage is represented by certain silicious pegmatites and aplites and certain quartz veins or dikes of pegmatitic origin. The fluid which crystallized as quartz in this case, may be called a magma, fully as much as that from which the pyroxenite or the granite crystallized.

In the confusion and uncertainty that has arisen as to whether pegmatites are igneous, aqueous, or aqueo-igneous; whether they are veins or dikes; and

†Else we should have had all magmas entirely differentiated long geological ages ago. The history of rock succession, as observed, for example, in the lavas of the Great Basin, shows that, once differentiation has begun, it may be carried to a close in a relatively short geological period—in a fraction of the Tertiary period, for example.

whether they are intrusive or deposited in place: the stumbling-blocks have been words even more than ideas. I suggest, therefore, that as most if not all igneous rocks owe their composition in some part to water in the magma, and as pegmatites owe their origin and composition to heat as well as water, it would be more correct to consider the whole as aqueo-igneous rocks; or, more accurately, as crystallized-magma rocks; a definition to be taken with that given above for magma. I also suggest that the terms 'dike' and 'vein' as separate terms are misleading, and that the strict limitations of their meaning are the results of misconceptions; and that it might be better to confound the two, or use 'vein' in both senses. While this may shock the conservatism of the average reader, the Germans, exceptionally deep thinkers, have no difficulty in using a single word (*gang*) in this connection; and 'veins' of granite and diorite were often described by the earlier English geologists. It is also undoubtedly true that 'intrusive' igneous rocks may have crystallized entirely in place; and in the accurate sense, I submit that any 'mineral vein' is intrusive, into its country rock.

Most of the commercially valuable metals are numbered among the rarer elements; and these undergo the process of differentiation as well as the commoner elements. They tend to concentrate in the extreme products of magmatic differentiation. A few of the metals of this kind concentrate chiefly or entirely in the extreme basic rock-types: while a much larger number concentrate chiefly or entirely in the siliceous extremes; and some metals split, part going into one extreme and part going into the other. This last circumstance exposes a condition which is probably universal, namely, that the precipitation or solution of a given metal depends largely upon the chemical combination in which it may be with other elements, and not solely on its own properties. Chromium, platinum, and nickel appear to be among the metals segregated into ultrabasic rocks; and it will presently be submitted that the majority of valuable metals such as lead, zinc, gold, silver, tin, etc., go mainly into the ultra-siliceous residue, and in great quantity; while certain metals, notably copper (together with iron) segregate partly into one extreme and partly into the other.

The occurrence of ores of nickel, platinum, chromium, and copper as magmatic segregations in basic rocks like peridotites has been insisted upon by various writers; and also the characteristic occurrence in pegmatites of various valuable minerals, such as tin, molybdenum, and tungsten. I have also insisted, and still insist, that the latter may be characterized as magmatic segregations in the same sense as the former; it is high time to do away with this and other generally ill-understood terms, or use them accurately. I have also described the occurrence of gold in quartz veins so closely allied to pegmatites that they evidently represent only a slight further step in differentiation, and, more rarely, and usually in non-commercial quantity, in pegmatites; and insisted that in such cases the term 'siliceous magmatic differentiation' was the most correct one for the process to which they owe their origin.

To re-state in a different form ideas already explained, it must be understood that after each epoch of crystallization in a rock magma, there remains residual from the crystallized magma rock a more siliceous and aqueous magma, in which the proportion of water to silica becomes progressively greater, since an increasing amount of silica is deposited at successive stages, but very little water at any stage. Finally there results the highly siliceous and aqueous residual magma from which pegmatitic quartz veins have crystallized. With the progressive increase of silica and water, there is a corresponding increase of certain metals, a fact which is exposed by the final precipitation, in the pegmatites and pegmatitic quartz veins, of such rare metals as tin, molybdenum, tungsten, and gold, in considerable quantity (quite out of proportion to their relative amount in the earth's crust).

I now submit further that there results from the consolidation of the pegmatites and the pegmatitic quartz veins, practically all the accumulated water in the magma; that with this water is associated a greatly accumulated (concentrated or magmatically differentiated) quantity of the highly mobile and solvent elements such as fluorine, boron, and chlorine, whose presence in granite and pegmatite magmas is shown by such granitic and pegmatitic minerals as tourmaline, mica, and apatite; that much silica is present; and that there are also present many valuable metals, constituting a large portion (in some instances by far the greater portion) of the whole amount contained in the original body of magma.

I submit that from such a residual magma, quartz veins of later origin than the quartz veins closely allied to pegmatites are deposited, and that in them valuable metallic minerals are deposited; that from these veins a further residue results, still fluid under such conditions, but subject to partial consolidation (or to phrase it differently, precipitation) at a later period, under different conditions, involving chiefly a lowering of temperature; and that many successive stages of precipitation follow, the final stage being when the water has lost most of its heat, and has left behind nearly all of the elements with which it was associated, and to whose mobility and concentration it was so important; and, finding its way to the surface, mingles with the great body of surface and shallow-seated waters which has been so plausibly regarded as the accumulated residue of all crystallized magmas.

The successive stages, according to the theory I present, are marked by differences of earthy minerals, but more delicately, perhaps, by changes in the metallic minerals.

This is the origin of most mineral veins and other forms of ore-deposits, including ores of lead, zinc, copper, silver, gold, bismuth, antimony, arsenic, and other metals.

According to this theory, the metallic hearth, or the factory in which the ores originate, is the zone of differentiation, which is in the lower part of the zone of crystallization. Here the ores which we find

segregated into coarse-textured basic rocks are concentrated, and here also the ores which we find in pegmatites and allied quartz veins; and here are prepared the highly silicious, aqueous, and metalliferous residues from which the majority of ore-deposits are formed.

With the increase in the amount of water comes greater mobility and power of penetration, and the upward tendency of the hot residues results in their passage along openings, especially such as are afforded by fault-fractures, toward the surface. Thus, while pegmatites and pegmatitic quartz veins usually occur in or very close to the earlier consolidated rocks, the successive stages migrate farther and farther away from the metallic hearth (the zone of differentiation); which, in general, means that they are successively deposited nearer and nearer the surface. **Thus the successive stages can be recognized as successive vertical zones of ore-deposition.**

A preliminary attempt, open to much revision, may be made to define some of the principal zones, beginning from the bottom:

1. The pegmatitic zone, containing tin, molybdenum, tungsten, etc., with characteristic gangue minerals, such as tourmaline, topaz, muscovite, beryl.
2. The free gold-auriferous pyrite zone, with coarse quartz gangue.
3. The cupriferous pyrite zone.
4. The galena-blende (galena usually argentiferous) zone.
5. The zone of silver and also much gold, usually associated with metals which combine with them to make substances which are undoubtedly highly mobile, and account for the relatively elevated position of the zone. These associated metals include antimony, bismuth, arsenic, tellurium, and selenium. Characteristic minerals of this zone are tellurides and selenides of silver, gold tellurides, argentiferous tetrahedrite and tennantite, polybasite, stephanite, and argentite.
6. The zone of earthy gangues, barren of valuable metals.

I believe it will be ultimately possible to subdivide these periods. The zone here called No. 5 is believed to be represented, for example, by the middle Tertiary 'bonanza' veins of Nevada and Mexico (these also frequently show the lead-zinc zone and in some cases the copper zone); the lead-zinc zone (No. 4) by the probably early Tertiary ores of Colorado; the copper zone (No. 3) by the late-Cretaceous-early Tertiary ores of the southwestern United States and Mexico; and the gold zone (No. 2) by the immediately post-Jurassic ores of the Sierra Nevada in California. The ores cited as typical in the provinces mentioned show always a decided range, transitional into both upper and lower zones in most cases; and the differing character of the veins of one province from those of another is believed to be to a subordinate degree dependent upon the magma whence they emanated, but principally upon the relative depth exposed by erosion, which, other things being equal, depends upon the age of the deposits.

Within the zones which have been defined, of course, precipitation is not continuous, but is influenced by local conditions; so that there may result in a vertical section of orebodies or zones of deposition separated from one another by barren intervening spaces. Yet in many veins the passage of one zone into a lower one is indicated with increasing depth, such as the change from the silver-gold zone to the lead-zinc zone.

An especially valuable record is afforded along certain fissure-zones that have been repeatedly cemented and re-opened during the mineralization period. Since such a mineralization period is usually of considerable duration, at any given point the ascending waters will grow cooler and cooler, with the downward progress of the cooling of the parent magma, and the consequent sinking of the metallic source; thus the successive zones of mineralization will migrate downward, and successive cementations of successive openings at a single horizon, will show the superposition of one zone upon another originally distinctly lower. Of course, the fidelity of the record depends upon the number of re-openings. Where such re-openings have not taken place, or are not marked, the succession may be recorded in neighboring veins of differing types, which may be parallel or intersecting, and which may represent different zones, deposited at different times.

It is believed, as before stated, that the metal-bearing fluids spring from the zone of differentiation; and the veins deposited by them are usually associated with rocks of intrusive or effusive character, which have been derived from the same source. Frequently the upward passage of such intrusions has broken channels along which the metalliferous fluids subsequently find their way, often on or near the contact, and in many cases within the intrusive rock or in the neighboring intruded rock. Movements attendant upon adjustments of equilibrium following magma migrations bring about repeated faulting and fissuring, along which, in succession, magmas of the common rock-types and metalliferous residues rise. Such fissures or lines of weakness, though filled and cemented, will ordinarily be re-opened at the next strain; thus dikes or volcanic plugs of the ordinary rocks and metalliferous veins often lie side by side, or are superimposed one upon the other.

The close relations between most ore deposits and igneous rocks have been well recognized of late years; but the reason does not appear to be that the ores were leached from the consolidated rocks with which they are associated; nor usually, as has more lately, and with a nearer approach to the truth, been held by the more advanced school, that the ores were deposited by solutions residual from the consolidation of the igneous body with which they are associated; but that, where (as in most cases) the associated rocks do not show differentiation phenomena, both rocks and veins were derived from a common centre. Thus similar veins may be (in different instances) most closely associated with different rocks, and different veins with the same rock; and

the error in supposing a very close connection between rock and vein is a most easy one. At Santa Barbara, in Chihuahua, Mexico, the veins lie in shale, and the only igneous rocks in the immediate vicinity (except later flows of andesitic lava are prominent rhyolitic dikes. From this it might be inferred that the veins were dependent upon the dikes; but actually the latter are distinctly subsequent, and have broken through the former. At Tepezala, in in Aguascalientes, a certain strong and persistent vein (the Peñuela) is everywhere found on one contact, or both, of a rhyolite dike; but examination shows conclusively that the dike is younger than the vein, and has split it. Dikes somewhat older than the vein occur at a little distance; but any tendency to the close connection of the vein and these dikes, inferred from proximity, is avoided by a consideration of the closer proximity of the later dike, with its glassy sanadines. At Idaho Springs, in Colorado, the Stanley vein follows a fissure that had previously been followed by a dike, which it splits or borders; and subsequent to the vein this fissure was followed by a dike of a different rock, which splits or borders the vein. The relation records the succession of magmatic products here introduced; but any tendency to regard the vein as dependent directly upon the earlier dike, on account of the close connection of the two is neutralized by the presence of the subsequent dike, which manifestly could not have been squeezed out of the vein.

Where orebodies occur in, near, or following the contact of igneous rocks, there is evidence, in every case that I have seen (with the exception of certain pegmatite veins and pegmatitic quartz veins), that ore deposition was distinctly subsequent to rock consolidation; and hence that the ore was derived from some deeper horizon. This is true, among other instances, in the case of the copper deposits with lime-silicate gangue, which have been largely produced by replacement of limestone at the contact with siliceous intrusions, and which are frequent in Arizona and Mexico. In every one of the several cases that I have carefully studied, these deposits (which come under zone No. 2 of the above classification) are distinctly younger than the consolidation of the associated intrusive (usually granite or monzonite).

A sub-magma emitted from the zone of differentiation may crystallize with different textures, dependent upon its coming to rest at a considerable depth, at the surface, or in an intermediate zone. In general the coarser texture is evidence of slower crystallization, and therefore, roughly signifies that consolidation has taken place at a greater depth; while the wholly or partially dense, glassy or finely crystalline rocks give evidence of rapid cooling, which signifies that consolidation took place in a relatively cool zone, and hence one near or at the surface. The meaning of such evidence is flexible, for the texture also depends upon the mass of cooling rock.

In general, however, it is probable that the main vertical zones of ore deposition coincide with less distinctly marked vertical zones of rock texture (for a given rock composition), where the veins and igneous rocks have nearly the same period of intrusion. Thus the pegmatitic gold-quartz veins and other pegmatitic ore deposits (zones 1 and 2) are usually associated with medium to coarsely granular pegmatitic and aplitic textures; the principal copper zone (zone 3) usually with medium-granular to coarse porphyritic textures; the principal galena-blende zone (zone 4) with medium-grained porphyritic rocks—the typical 'porphyries' of the older classification; while the gold-silver ores of the superficial class (zone 5) are typically in fine-grained porphyritic rocks which frequently represent surface volcanics.

The explanation advanced above is not offered as a universal one; but it does cover, with a few doubtful exceptions, all the important deposits of metals (except many deposits of the most common metals, such as iron, manganese, etc.) with which I am personally acquainted, and in its different applications it will, I believe, cover the most of the field.

Summing up, this theory proposes that metalliferous fluids, from which most ore deposits are precipitated, are extreme differentiation phases of rock magmas; that most ore deposits and mineral veins, as a class, represent one or the other of the extreme products of magmatic differentiation; and that the most striking chemical differences between ore deposits is due (in the more important class representing the silicious extreme) to successive precipitation in theoretically vertical zones, as the fluid migrates toward the surface, and with diminishing heat, achieves more and more mature crystallization. Secondarily, the differences between ore deposits in different regions depends upon different metallographic magma-provinces.

Tungsten Lamps in Michigan.—The city of Grosse Point, Mich., has recently installed a series tungsten incandescent street lighting system where the advantages of this kind of lighting are well exemplified. The lamps are exceedingly hardy on account of the heavy, short filament. They will burn for nearly 1000 hr. at an efficiency of from one and one-quarter to one and one-half watts per candle-power. Another installation of series tungsten lamps for street lighting has recently been made in Grand Rapids. This has proved highly satisfactory. The extensive use of tungsten in the manufacture of lamp filaments will open a new market for the ores of that metal and tend to steady the price.

Hubnerite in Montana.—The Birdie mine, about four miles east of Butte, is said to have the only commercially important body of hubnerite ore in Montana. It is an old silver mine and is opened by a 1000-ft. adit, a 250-ft. raise, and long drifts and cross-cuts. The hubnerite-bearing orebody is at the west end of the silver-bearing quartz; it is from 12 to 20 in. wide and from 6 to 10-ft. long. The raise follows the ore-shoot to the surface; at the surface the orebody is 3 to 5 ft. wide and about 20 ft. long. About 30 tons of ore that carries 20% tungstic acid were recently on hand in the ore-bin.

SODIUM PEROXIDE IN THE CHEMICAL LABORATORY.

Written for the MINING AND SCIENTIFIC PRESS
By HERBERT W. ROSS and N. M. ZOPH.

Much trouble is experienced in completely decomposing a reverberatory furnace slag by acid treatment alone. This is especially true if the percentage of alumina is large. In order to obtain accurate results a fusion with appropriate reagents is necessary.

The fusion of slag or ore in a nickel crucible with caustic potash and sodium peroxide effects a rapid and complete decomposition. A fusion mixture consisting of four parts of sodium peroxide and one part of caustic potash was found to yield the best results, as it melts more readily than sodium peroxide, and is a more powerful reagent than caustic potash. The two reagents should be mixed thoroughly by grinding together in a mortar. The fusion can be made at a very low temperature, even over an alcohol lamp. A number can be made simultaneously by resting the crucibles on a small plate of ⅛-in. sheet iron and placing the same over the full flame of a Dangler lamp. The cheapness of the crucibles, compared with the cost of platinum, is an important factor and favors the use of this method.

Slag Analysis.—One gram of slag is mixed in a 25 c.c. nickel crucible with 5 gm. of the fusion mixture. The crucible is heated for about 20 minutes at a temperature that will barely cause fusion. After cooling, the melt is placed in a casserole and disintegrated in a minimum amount of water (and it only requires a few moments). The crucible is rinsed off and removed from the casserole, the solution being evaporated to dryness after acidifying with hydrochloric acid. The residual silica is treated with hydrochloric acid and water and collected on a filter. Precipitates are most conveniently burned in small clay crucibles or annealing cups in a muffle.

Iron can be determined directly in the filtrate by the bichromate method. If it is desired to determine alumina, lime, and magnesia, iron and aluminum are precipitated by double ammonia precipitations, calcium and magnesium being determined in the filtrate. Nickel is precipitated with the iron and aluminum, on boiling off the excess of ammonia. By determining the aluminum in the precipitate by the phosphate method and the iron in a separate portion of the slag, the nickel will not interfere with the results. If iron alone is to be determined, a fusion can be made and iron titrated after disintegrating the melt in water, acidifying with hydrochloric acid, and reducing the iron to a ferrous state.

Ore Analysis.—The ordinary analysis of an ore or rock is conducted in the same manner as with the slag, except that a longer period is required for the decomposition.

Copper.—Sulphides and silicates are readily decomposed by fusing with sodium peroxide and caustic potash, leaving a melt completely soluble in acid. Two grams of slag or one of ore are treated in a nickel crucible in the same way as in the slag analysis. The melt is disintegrated with water and acidified with sulphuric acid, an excess of 5 c.c. being added. Practically everything dissolves. A saturated solution of sodium thiosulphate is then added in sufficient quantity to precipitate the copper. The solution is boiled until the precipitated copper sulphide and sulphur collect at the bottom of the beaker, leaving a comparatively clear solution. The precipitate is collected on a filter paper, dried, and burned at a low temperature in a small glazed porcelain crucible. The crucible is placed upright in a beaker containing hot water. Concentrated nitric acid is placed inside the crucible and the water in the beaker is boiled. When the copper has dissolved, the contents of the crucible are washed into the beaker and the crucibles removed. In the case of slags, 10 c.c. ammonia are added and copper determined by the cyanide method. The iodide or electrolyte methods may be employed, if desired, after obtaining the copper in nitric acid solution.

The method has been found to give accurate results. A perfect decomposition of the ore or slag is generally obtained. The assay is much more rapid than the ordinary wet method. No unpleasant fumes are evolved. Only one filtration is required in the process. Altogether this method of copper assay is the most satisfactory one that has been tried by the writers of this article.

Sulphur Determination.—Half a gram of ore is sintered in a nickel crucible with three grams of the fusion mixture. The melt is dissolved in water, acidified with hydrochloric acid, and sulphur precipitated with barium chloride.

Arsenic.—By treating an arsenical ore with the fusion mixture, we have a convenient method of converting the arsenic into arsenic acid, so that it can be precipitated by means of magnesia mixture.

Chromium.—Testing chrome iron or chrome brick with the fusion mixture furnishes the best method for decomposing the insoluble chromates.

These methods, as briefly outlined above, have been in use in the laboratory of the Union Copper Mining Co., at Copperopolis, California, for six months and have proved entirely satisfactory.

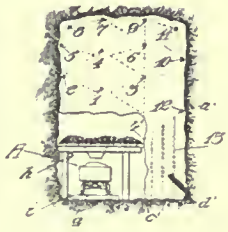
ALABAMA GOLD MINES.—The gold belt enters Alabama from Georgia and terminates in the centre of the State. In the past both placers and quarts veins have been productive, but in recent years activity has been almost confined to the quartz mines. The veins occur in gneisses, schists, and slates; they are in fissures or in bedded and lenticular form. The counties that have produced gold are Chilton, Clay, Cleburne, Coosa, Elmore, Randolph, Talladega, and Tallapoosa; of these, only the last was productive in 1906. The Hog Mountain mine is developed by a 100-ft. shaft and by 350 ft. of drifts. It is equipped with a 40-ton dry-crushing and cyanide plant. The Tallapoosa Mining Co. made a small production in 1905 and 1907, but not in 1906; during that year a 5-stamp mill and cyanide plant were erected. The Dutch Bend mine is equipped with a 20-stamp mill and a cyanide plant; its production in 1906 was small. In Randolph county, at the Pinetuckey mine, there is a 20-stamp mill equipped with Wilfley tables. The mine was developed in 1905 by two vertical shafts, 80 and 125 ft. deep, one incline shaft, and about 600 ft. of tunnels. In Cleburne county, at the Mossback and Lucky Joe mines of the Turkey Heaven district there are 10-stamp mills and at the Gold Hill mine there is a steam 2-stamp mill. A dredge was operating at Clear Creek in 1906 and there were placers at Arabacooche and Chulafinney. The Idaho mine in Clay county has not been operated for some years. The precious-metal production of the State in 1906 was 1205.51 fine ounces of gold, valued at $24,921, and 124 fine ounces of silver, valued at $83.

THE ORE from the mine of the Dominion Antimony Co. at West Gore, Nova Scotia, contains auriferous stibnite in a quartz gangue. In making concentration tests on this ore, wet crushing was found to cause too great a loss from slime carried away in the water. Dry graded crushing, and careful sizing to 24 or 30 mesh, followed by wet concentration, seemed to give better results. In one test 6¼ tons were crushed with rolls to 24 mesh and treated on a Wilfley table; this yielded concentrate, middling which was returned to the table, sand tailing to be leached for gold, and slime. There was a saving of 90% of the antimony.

MINING AND METALLURGICAL PATENTS.

Specially Reported for the MINING AND SCIENTIFIC PRESS.

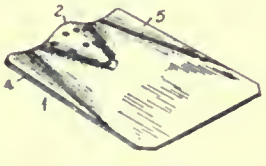
METHOD OF TUNNELING IN ROCK.—No. 877,779; Joseph P. Keane, Wallace, Idaho.



The method of tunneling which comprehends the shooting of the cut substantially simultaneously partially with tape and partially with electric fuse. The method of tunneling which comprehends running a heading along the bottom or track level and along one permanent side of the tunnel, building a staging with sufficient clearance underneath for the passage of the ore-cars, provided this staging with suitable openings over the line of travel of the ore-cars and then casting down the material on to the staging to the roof-line.

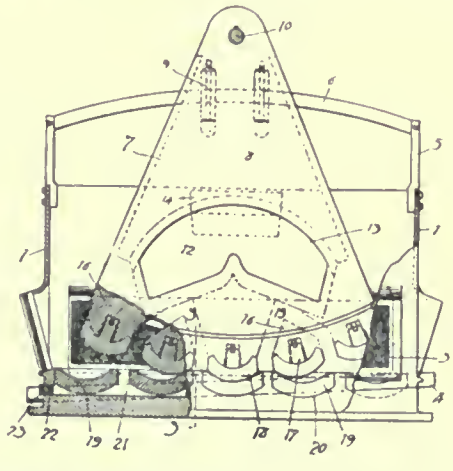
MINER'S SHOVEL.—No. 877,574; David B. Lewis, Bisbee, Arizona.

A square shovel blade composed of a single thin sheet



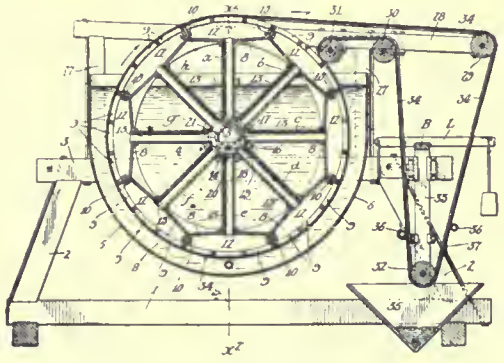
of metal having its front portion flat and straight across its entire width with the sides thereof curved upwardly at the rear end of the blade and bent outwardly and downwardly toward the front, merging into said flat front portion near the middle of the blade and with their inner faces lying in approximately a horizontal plane, said sheet having its rear end bent upwardly from a point beyond the middle, whereby a central depression is formed to receive the material to be lifted.

STAMPING AND GRINDING MILL.—No. 877,615; Thomas M. Topp, Richmond, California.



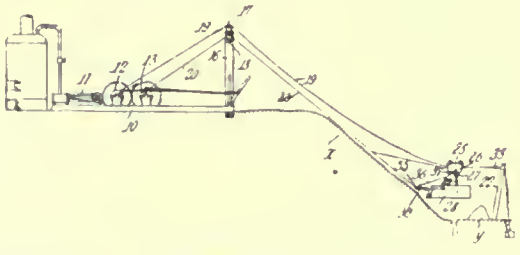
A stamping and grinding mill comprising a mortar, a row of concave dies therein, a pestle having a corresponding row of convex shoes at its lower end, and means for imparting a rocking motion to said pestle in the plane of said row, the mortar and pestle being provided with devices arranged to engage each other to maintain the pestle in an upright position while so rocking, one of said devices being capable of rotary motion, for the purpose of reducing friction, substantially as described.

SLIMES-FILTER APPARATUS.—No. 877,631; Edwin M. Clark, Los Angeles, Cal., assignor to Edwin M. Clark Slime Filter Company, Los Angeles, Cal., a Corporation of South Dakota.



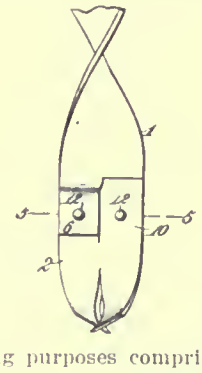
In a slimes filter apparatus, a wheel having a perforated rim with grooves near each edge of the rim, a pervious belt traveling over said wheel, a belt having welts in each edge which closely fit the said grooves and prevent leakage between the edge of the belt and wheel, the rim of the wheel being formed in hollow sections, a tank containing the liquid to be filtered in which the wheel is immersed, means for applying suction to hollow sections of the rim to draw the liquids through the pervious belt into the hollow sections and cause the solids to adhere to the belt, and means for limiting the suctions to sections which are fully immersed in the liquid or covered by the belt.

EXCAVATING-MACHINE.—No. 877,578; Milton S. Longnaker, Pleasant Hill, Ohio.



In apparatus of the class described, an inclined cable or support, means for slackening and drawing the cable taut to alter its degree of inclination, a movable carriage arranged to travel on the inclined cable and movable thereon in one direction by gravity, and an operating cable connected to said load carrier and arranged to haul the same in the opposite direction.

DRILL.—No. 877,892; Aaron E. Jennings and James W. Jennings, Central City, Ky., assignors of one-third to Gregory Jennings, Lima, Ohio.



A drill for mining purposes comprising a shank section and a bit section, said shank section having its lower portion formed with a pair of tongues offset with respect to each other, said bit section having its upper portion offset to form shoulders and further having a notch in the top edge thereof, said upper portion of said bit section adapted to be positioned between and overlapped by the tongues of the shank section, and said tongues bearing against the shoulders of the bit section and means for securing the shank section to the bit section.

GOLD PRODUCTION AND ITS EFFECT.

By F. Lynwood Garrison.

*The world's gold production has not reached an abnormal or unhealthy proportion when compared with the enormously increased commercial activities of the times. On the contrary, if anything, we need more gold, for business seems to have outgrown the supply of circulating medium, that is, coined money or currency. Gold is certainly not cheaper, and as some of the chief present sources of supply are exhibiting indubitable signs of exhaustion, it is not likely to become so. It is therefore evident that if the present rate of increase is to be maintained we must soon call upon the comparatively undeveloped fields of Siberia, Central and South America, and perhaps parts of Africa.

Continuing this analysis further, we find it is evident that the quantity of gold derived from copper ores must be quite large. In the statistics for Arizona and California, this particular phrase of the yield seems to be given only in terms of silver, that is, the amount of gold thus derived is not specifically stated. In Montana, however, $1,434,935 of the total $4,889,233 of gold produced by that State in 1905 came from the copper ores; that is, about 29% of the gold yield of the State was thus obtained, and in 1906 it was probably much larger. New Mexico, for 1905, gave $76,455, or about 29%, from copper ores, while in Oregon it was only 1½%. Within the old gold-producing States it seems we shall in the future have to look to the dredging industry and the copper ores for the increase of gold production, if, in fact, we are not obliged to depend upon these sources to maintain the present amount and prevent a steady decline. The total yield of gold as an incident of the copper industry is evidently an important element, although the precious metals thus derived are proportionately very small and may be regarded as a by-product, since copper ores do not usually contain more than one or two dollars of gold and silver per ton, the ratio being about one part of gold to three or four of silver. The yield of these metals from this source will therefore depend upon the production of copper, which in turn is regulated by the price of that metal.

From a careful consideration of the whole subject, it is evident that the gold production of the United States (not including Alaska) is not likely to continue exhibiting a substantial increase, if it can maintain its present rate. There are doubtless many gold deposits of one kind or another in the United States that could be made to pay enormously in a country like China, where there is an abundance of cheap, and for the purpose, efficient labor, but in this country of high prices and extravagant living, such deposits would probably not yield a new dollar for an old one, even with the best of our so-called and sometimes over-rated labor-saving appliances. I believe it is an error to suppose modern mining and metallurgical methods can or will materially modify the gold production of the United States, although of course in some, and perhaps quite a number of instances, the yield of gold can in this way be increased, but as a factor of the whole question these modern innovations may be said to be comparatively unimportant.

Gold is not, as commonly supposed, a rare metal, indeed it is quite a common one in the crust of the earth, but it is exceedingly widely distributed and finely disseminated. It probably occurs in appreciable, though minute quantities throughout many, if not most of the Tertiary eruptive rocks that compose the vast chain of mountains extending from Alaska on the north to Tierra del Fuego on the south. The gravels underlying Philadelphia contain it, and the iridescent though dishonest scheme of Jernegan was based upon the substantial fact that gold does occur in sea water. The forces of Nature through millions of years have concentrated some of this gold in certain places favorable to its accumulation. By common process of erosion the particles of gold gather in stream-beds, sea-beaches and other alluvial and fluvial deposits. Through its solution in the circulating "waters under the earth" gold is carried from place to place in the rocks and precipitated in favorable spots, usually along with other metals. The phenomena involved are very obscure, but are slowly yielding to scientific study and research. In general, it may be said that the processes of metallic accumulation within the rocks are essentially superficial in the sense that they are probably going on at no great distance below the surface. Metallic veins and deposits do not usually increase in size or richness with great depth, although there are of course some mines that can be worked about as far below the surface as our present mechanical limitations will admit.

*Abstracted from the proceedings of the Franklin Institute, Philadelphia.

Distances.—From New York to San Francisco the distance shown by rail across the continent is 3191 miles; via Tehauntepec, 4415 miles; via Panama, 5305 miles; via Punta Arenas, 13,089 miles, and via Suez and Singapore, 17,672 miles. From New York to Nome, Alaska, the distance via Port Townsend is 5555 miles; via San Francisco, 5896 miles; via Tehauntepec, 7130 miles; via Panama, 8010 miles, and via Magellan Straits, 15,840 miles. The length of route from Vladivostok, Asiatic Russia, to New Orleans via Magellan Straits, is 17,445 miles, while the distance from Vladivostok to New Orleans via San Francisco and thence by rail is but 7188 miles. The distance around the world via the Trans-Siberian and our own transcontinental railway lines is shown to be 17,997 miles, being: from New York to St. Petersburg, 4632 miles; from St. Petersburg to Vladivostok, 5809 miles; from Vladivostok to Port Townsend, 4357 miles, and from Port Townsend to New York, 3199 miles. The sailing distance around the world from New York via Suez, Singapore, Manila, Guam, the Hawaian Islands, and Panama Canal to New York again would be 23,092 miles, being in detail: from New York to Singapore, 10,170 miles; thence to Manila, 1386 miles; thence to Guam, 1506 miles; thence to Hawaii, 3337 miles; thence to Panama, 4665, and thence to New York, 2028 miles.

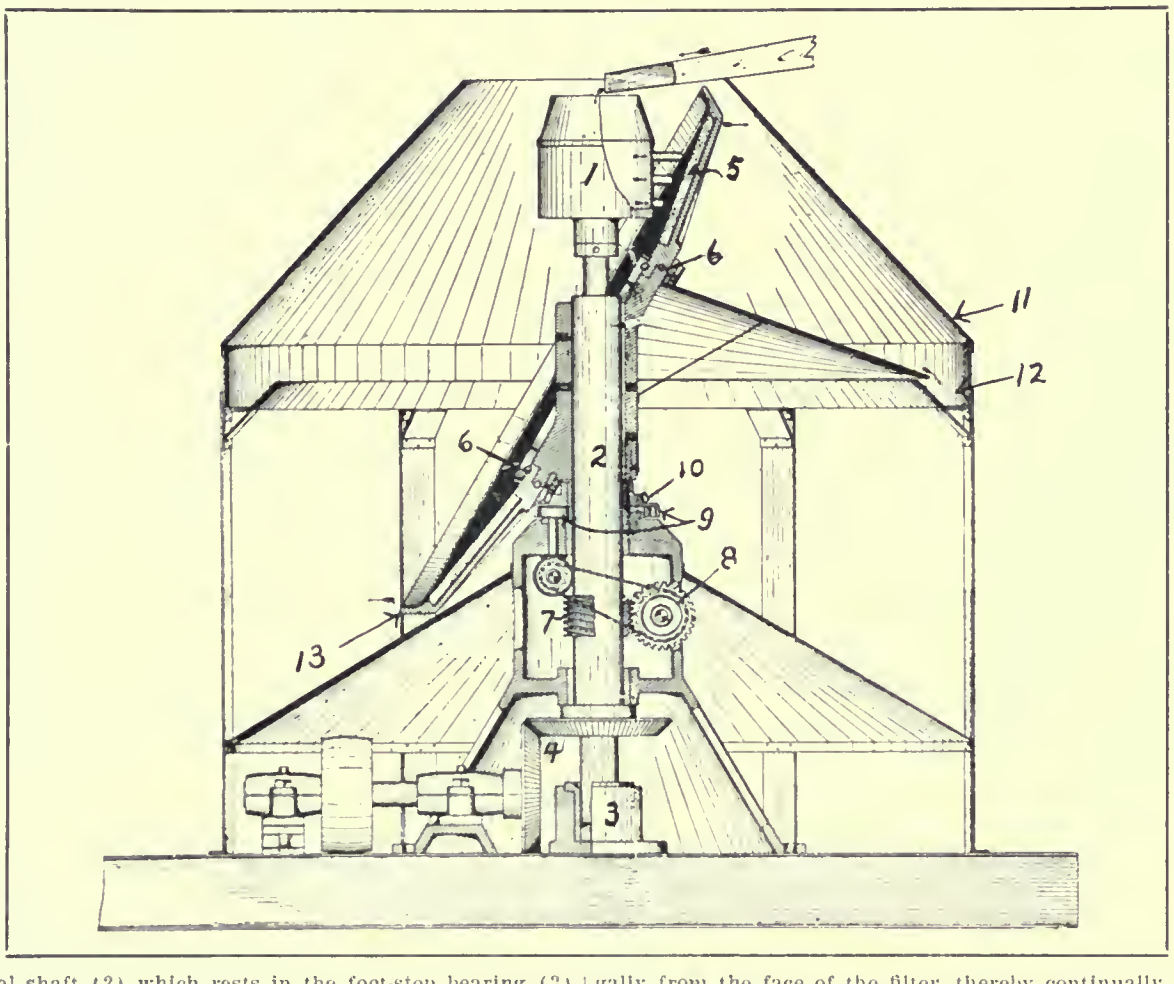
A New Continuous Filtering and Straining Machine.

The continuous filtering and straining machine of L. C. Trent is a new candidate for favor among engineers interested in filtering and straining. It is intended to separate finely divided material, of any description, from liquids, and is claimed to be the missing link required to form a continuous cyanide process. The inventor claims it will separate a stream of pulp from a stamp-battery or any other stream of liquids carrying solids, into a continuous flow of clear liquids on the one side and a stream of comparatively dry solids, on the other. The design is so ingenious and novel that it is worthy of close study, on account of the numerous closely woven forces set in motion and employed in its operation.

The machine consists of a receiving hopper, marked (1) on the accompanying drawing, and revolving with the vertical shaft (2) which rests in the foot-step bearing (3) and is driven by the bevel gear (4). The revolving dish-shaped filter-mat (5) is attached to, and is carried around by, the vertical shaft (2) at a speed of from 200 to 600 rev. per min., generating the centrifugal force and wind-pressure for filtering and discharging. This filter-mat (5) at the same time revolves on its own axis at 30 rev. per min. and is carried by the ball-bearings (6). The power for revolving the filter-mat (5) is transmitted by the worm-gear (7) through the sprocket and chain-drive (8) and annular gear (9) and bevel gear (10), thus forming a ready means of altering the relative speeds of revolution of filter-mat to vertical shaft.

After the correct relative speed has been determined for any constant class of material, a simpler drive can be used for this purpose. Also, if desired, a top drive with quarter-turn belt can be used for the vertical shaft (2) in place of the bevel gear (4) here shown. The upper portion of the machine is enclosed by the housing (11) and surrounded by the launder (12), which collects the filtered solution. The solid material is discharged at (13) and may be collected in a hopper under, or at the side of, the machine, from which it can be removed by a conveyor-belt, sluicing, or other means.

In operation, this revolving-disc filter has a first or primary motion, wherein the inclined disc revolves rapidly in a horizontal direction with the spindle (vertical axis), which produces a centrifugal pressure against the face of the upper half of the filter which does the filtering. The same force takes place in an opposite direction from the surface of the lower half of the filter, which discharges the filtered solids at the same time the disc-filter revolves on the axis of its plane, which is the secondary or distributing motion. The first motion described creates a strong centrifugal pressure on the upper face of the filter against which the material to be filtered is discharged from a small reservoir revolving with the machine, and the strong centrifugal action instantly strains the liquid from the solids, the latter remaining on the face of the disc-filter to be carried by the revolving or secondary distributing motion to the lower portion of the filter, to a point where it is ejected centrifugally from the face of the filter, thereby continually cleaning the filter face, which returns with a clean surface for a fresh charge. Thus the machine, when in operation, is constantly feeding and as constantly discharging.



The centrifugal force is not only active at the top, tangentially to the main spindle of the machine, but with the filter-disc dished, it is equally strong tangentially from the horizontal radii of the filter-disc, as the action is then oblique and has even greater force in filtering; the wind-pressure and adhesive force together, with a partial vacuum created by the centrifugal force, act on the moisture absorbed by the mat, holding the solids in place. The material, striking a clean surface, is instantly deprived of most of its liquid contents and the solids are carried to the lower half of the filter, where they are discharged by the same force that filters them, and the filter is cleaned for continued action.

By this method, the cake is always thin on the filter-faces, consequently, easily filtered, a clean filter-surface is continually provided, thus avoiding any necessity for the high pressures required in filter-presses and ordinary centrifugal machines. The action of the machine is continuous, both in feeding and discharging, and the discharged material is finished as far as mechanical methods of remov-

ing moistures can be employed, the degree of dryness being regulated by the speed of the primary motion that regulates the straining or filtering pressure, and the speed of the secondary motion, which regulates the time of exposure of such action.

In a machine with a 4-ft. diam. of filter-disc, the available filter-area will be 8 sq. ft., and if the vertical axis of this machine is revolved at 400 rev. per min., and the disc revolves on the axis of its plane at 30 rev. per min., and a cake of slime ⅛-in. thick be collected, it will have a capacity of 140 tons of dry ore per 24 hours and will require less than 20 hp., and no labor or attendance further than an occasional oiling and looking over.

This machine is patented in the United States and principal foreign countries, and is the invention of L. C. Trent, of the L. C. Trent Continuous Filter Co., of Reno, Nevada, who is now perfecting the machine for the market.

Books Reviewed.

The public that reads technical literature is often imposed upon by having to digest half-baked productions likely to cause mental dyspepsia. During recent years we have seen nothing quite so bad as 'The Falls of Niagara' by Joseph William Winthrop Spencer, M.A., Ph.D., F.G.S., published by the Geological Survey of Canada. We marvel that such a volume of cool egoism, muddy thinking, and wretched writing should have been issued from the office at Ottawa, for we believed that the regular editor of the Canadian Survey was a mining engineer of some repute, possessed of an excellent literary style, and the necessary good taste in matters of this kind. The book is well printed and beautifully illustrated; in fact, the manner of it is disproportionate to the matter. As a warning and example of bad writing we quote seven paragraphs.

"The history of Niagara river is only the expression of that of the lake region in all its complicated parts. The investigation of one feature imperceptibly leads us afield until we pass the boundaries of our original topic; thus it is here. But the new observations react and more fully explain the phenomena."

"In a general way the recession of the falls depends upon three factors—their height, their volume, and the character of the rock formations, which are being channelled by the stream. The falls have retreated across a very level country, underlaid by almost horizontal rock formations having a great degree of uniformity, as was noted even so long ago as 1789."

"Few people have supposed that the recession was not uniform; fewer still would think that the story had not all been told concerning a commonly known natural feature. The history had been partly anticipated in the discovery that the volume and descent of the water have not always been the same, and that some of the features have changed to a degree."

"The old floor of the Park is so nearly 180 feet above the river in the channel below, or 280 feet above Lake Ontario, that this height may be taken as effective in the excavation of the gorge with the river at present level, thus making allowance for its increased velocity."

"The thickness of the underlying shales is constant. As I have found the character of the falls during the middle portion of this long stage, these corrections will approximately cover the case, although their precise amounts are not determined more closely. I do not believe that the apparent error will ever be found to reach ten per cent, with the rainfall during the recession being approximately the same as at present."

"The age of the Falls of Niagara, which are post-glacial, is one of the great questions of geology having a world wide interest. The complexity of their history, which meets one on investigation, disappears in applying precise methods and carrying them sufficiently far. It was principally due to a failure in understanding the nature of the differential uplift of the land, and tilting of the water-basins, so as to change the height of the falls and their volume; and to previous failure in making the determination of the work of the falls at the different stages in their history."

"There need be no suspicion that underlying hypotheses have been developed, as I had none to uphold, except what might come from the facts inductively. The problem has been a long one to solve, so that no one who has not at least examined the investigations is entitled to call in question the features of the falls, gorge, etc., as to their furnishing evidence in bringing us near the age of Niagara, even though he may be bewildered by the great mass of facts brought out by methods that had to be specially developed for this solitary problem."

This is the delirious trimmings of scientific literature; as you read it you wonder if you have lost your senses, you suspect the Welsh rabbit (not rare bit) of last night and you vow to stick to mineral water in future. Yet we would be disinclined to be so severe, if the author had not put himself on a pedestal. According to him, all previous writers on Niagara were fools, although we remember a modest pamphlet by G. K. Gilbert, who managed in 29 pages to give more facts, and to illuminate them better, than Dr. Spencer in his 490 pages. Surely the Geological Survey of Canada can use its funds to better purpose than to issue scientific balderdash sumptuously printed. One purpose the book can fulfill: It illustrates every kind of error in arrangement of evidence, in sequence of thought, in construction of sentences. If you want to write an essay on a scientific subject, you can at least learn what to avoid by reading 'The Falls of Niagara.'

'Steam-Turbines,' by Carl C. Thomas, Professor of Marine Engineering, Sibley College, Cornell University. Third edition, revised and enlarged, 1907; John Wiley & Sons, New York; 8vo xiii and 334 pp., 145 fig., 20 pl.; cloth, price $4. This book has been written primarily for students and other persons possessing a fair knowledge of mathematics who may desire to equip themselves for taking up steam-turbine work. Special attention may be called to the new problems in the design of the Curtis and the Parsons types of turbines, to the suggestions regarding turbine analysis, and to the 'Diagram of Heat-contents of Steam,' the superheated region of which is plotted from the results of the author's recent investigation of the specific heat of superheated steam. This edition also contains new material relating to the application of steam-turbines to marine propulsion, including illustrations of some of the most recent turbine steamers. For sale by the MINING AND SCIENTIFIC PRESS.

Catalogues Received.

CHALMERS & WILLIAMS of Chicago, Ill., have issued a substantial cloth binder containing their 'Catalogue No. 1,' second edition. This catalogue is in sections as follows: Section A, rock breakers; Section B, stamp batteries and accessories; Section C, gold and silver milling machinery; Section D, Huntington mills and crusher rolls; Section E, Frue vanner; Section F, concentrating machinery; Section G, the New Blanton patent self-tightening cam; Section H, hoisting cages and landing dogs; Section K, Chile mills; Section L, Kennedy gyratory crusher.

THE AETNA POWDER CO. of Chicago, Ill., has issued a catalogue entitled 'Aetna Dynamite'; besides describing the company's manufactures, it contains much useful information about loading and firing blasts and about blasting under water, blasting ice, shooting wells, and blasting stumps.

THE SCHUTTE & KOERTING CO. of Philadelphia, Pa., has sent us its 'Catalog 4, Section Q, which describes and illustrates its water-jet primers.

THE LIMA LOCOMOTIVE & MACHINE CO. of Lima, Ohio, has issued a nicely illustrated catalogue describing the Shay geared and rod locomotives

THE SULLIVAN MACHINERY CO. announces that George M. Bertram, for several years connected with this company, is appointed local manager of its Joplin, Missouri, branch office, succeeding Randolph D. Talmage.

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Editorial.

FURTHER NEWS from Rawhide will be found under 'Special Correspondence.' It is evident that the stampede is attracting the adventurous from all over the West, and we hope that the real work of mining will be undertaken vigorously.

TECHNICAL WRITING forms the subject of an interesting letter sent to us from the wilds of Sinaloa by Mr. A. W. Warwick. His communication contains a lot of good sense and useful advice. It is said that "you cannot teach an old dog new tricks," and it may be that the seniors of the profession will be more annoyed than aided by advice in such matters, but we are glad to help the youngsters. The future is to them and to the MINING AND SCIENTIFIC PRESS.

TUBE-MILL LININGS have come to the front lately, both by reason of the increased usefulness of the tube-mill as a machine for re-grinding and because of a little friendly controversy in regard to the origin of a certain improvement in which flinty pieces of ore are held in cement so as to serve as an agent of abrasion. Mr. J. R. Brown's letter gives courteous expression to his claims as an inventor and it is likely to be well received by his fellow practitioners.

JOPLIN is the greatest lead-producing region in America, therefore an article describing the occurrence of the ore is sure to be interesting, but the contribution of Mr. F. Lynwood Garrison has further claims to attention, as being a scholarly essay prepared by a mining engineer who is also a geologist. The discussion of the origin of the ore and the comparison between the various theories suggested by scientific men, should prove instructive and suggestive to those engaged in the exploration and exploitation of lead deposits elsewhere.

CHINA is not a popular region among mining operators, but to such as are interested in that awakening country the regulations recently issued by the Imperial Government will be important. The regulations afford valuable evidence of the present feeling of Chinese officials toward foreign capital, and of the way in which mining operations are likely to be hampered. It is not considered at all likely that the signatory Powers will agree to the regulations in their present form; in all probability a new set will have to be drafted and the whole matter will remain in suspense for some time to come. The rate of progress now observable reminds one of a variable approaching its limit—it never actually gets there. On the other hand, if we take a more

cheerful view and suppose that the idea of a provincial mining bureau can be carried out adequately, there should be a stimulus to mining. In Sze-chuan a good start has been made as regards the bureau in that province, and Mr. Lo Su Chi, who graduated from the University of California last year, has been appointed to the post of Provincial Geologist, and even more recently he has been sent into Manchuria to co-operate with the Japanese in the survey for a railroad. When the railroad gets into Sze-chuan there should be a noteworthy development of its mineral resources. With the exception of coal, and the solitary Shantung gold mine, the provinces of Sze-chuan and Yunnan appear to be the only promising regions open to foreign exploitation. A good deal is said about alluvial gold in Manchuria, but such general talk is not based on any precise information. There are numerous quartz veins in that country, but they are small. The working of the placer ground by expert panners, who expect to earn only 10 to 15 cents per diem, does not seem to offer much of an opportunity to modern machinery. There may be undiscovered Yubas and Tonopahs in China, but the best informed travelers do not favor any such joyous anticipations.

Revival in Gold Mining.

WHETHER RAWHIDE is another Goldfield or Cripple Creek remains to be proved, but we welcome the interest the discovery has evoked as evidence of speculative activity in gold mining, in Nevada in particular and in the West in general. Undoubtedly when banks fail, railroad shares shrivel, the price of copper collapses, and other such suggestions of instability are thrown at the intelligence of capitalists, whether large or small as regards the amount of money at their disposal, there is a tendency to turn to the industry least affected by drooping markets and timid manufacturers. That favored industry is gold mining. But by the industry of gold mining we do not mean the pestiferous activities of industrious schemers devoid of honesty and with such a sacred regard for truth—as not to use it. Our daily contemporary in San Francisco, *The Chronicle*, for example, prints two columns of balderdash concerning Rawhide couched in language calculated to discount any belief in the serious character of the mining operations that have been started there and full of weird statements such as would drive any well informed man to conclude that Rawhide was the particular rendezvous of wildcats. Such flapdoodle as *The Chronicle* prints will not help Rawhide nor Nevada, nor any form of legitimate mining. We read that "mining engineers give it as their opinion that these are true fissure veins, which means permanency and great depth." We are told further that "geologists are of the unanimous opinion that the formation of Rawhide indicates great depth to the orebodies, with increasing values showing with depth." This sort of twaddle is as old as the hills: in the days of Rameses they peddled shares by the aid of just such fables. Every intelligent man knows that such statements are the stock in trade of feline financiers, they are worthy of the steam-heated imagination of an aberrant reporter making copy for an irresponsible and disreputable newspaper. Again, we are told that the ore struck on one of these claims assays $920.90 per ton. Note the cents. As a matter of fact it is safe to say that there is not one ton of such stuff available, although there may be plenty of good ore, and what is meant is that a specimen assayed 46 cents per pound, or 3 cents per ounce, which is at the rate of $920 per ton, if there were a ton of it. This method of taking selected specimens and speaking of them as averages is extremely misleading to the public, and it is a method that plays into the hands of the unmistakably dishonest promoters of enterprises having as little to do with real mining as the thimble-rigger at the races has to do with the breeding of fine horses. By all means, let us have a revival of activity in gold mining—and if in Nevada, so much the better—but cannot we be spared the revival of the spoofery and malpractice that have ever been an incubus upon honest industry. Money is scarce, why waste it on air-ships; there is plenty of opportunity for applying it beneficently to the solid ground of ascertainable fact.

Biographical Note.

ONCE EACH YEAR the Bulletin of the American Institute of Mining Engineers contains a biographical summary of the members deceased during the preceding twelve months. We referred to this necrology last year and we shall do so again on this occasion, since it is sobering, even uplifting, to give a few moments to recalling the honored dead who have dropped out of the ranks of our profession, leaving a memory, an example, or a warning. The year 1907 saw the end of many useful careers; we mention John Blue, of Quebec; W. R. Boggs, Jr., who met a tragic death in Mexico, being stoned by a mob of workmen clamoring for their wages; E. E. Burlingame, the veteran assayer of Denver; George H. Evans, a hydraulic mining engineer, remembered in New Zealand, Colorado, and California; William Glenn, of Baltimore,, who contributed several valuable papers to the Institute; Frank H. Hearne, the president of the Colorado Fuel & Iron Company; George C. Hewett, of Colorado Springs, a worthy engineer; Thomas E. Johns, a Cornishman who made a record in South Africa; W. J. Johnston, the energetic publisher, one of the pioneers of technical journalism; Clermont Livingstone, the general manager of the Tyee Copper Company; Charles A. Molson, at the height of his reputation as a mining engineer, one of the leaders of the profession in America, who was killed through an accident while shooting ducks; Louis Pelatan, a clever Frenchman whose name is given to a variation of the cyanide process, he died from injuries due to a railroad accident; Alfred M. Rock, formerly on the Geological Survey, who forfeited his life in a courageous effort to do his duty in a mine fire; George W. Rose, a chemist and cyanide superintendent, who was killed in defending his wife against two Mexican burglars; G.

C. Simpson, a Scotch chemist who became an assayer and ore-buyer in Mexico; E. B. Willard, one of the ironmasters of Ohio, who was killed by the explosion of a blast-furnace; John A. Walker, of the Dixon Crucible Company, a veteran Scot of the best type, an honorable business man and a good citizen. In the Bulletin will be found paragraphs outlining the career and work of these men, who in 1907 crossed the range that guards the farthest horizon of life. Dr. Raymond prepared many of the biographical notices and they have that message to the living which is the best feature of a record of the dead. The veteran Secretary says that the list for 1907 is "peculiarly sad, comprising, as it does, so many sudden deaths by violence or accident, so many veterans, removed too soon, and so many young men whose early departure impoverishes the future even more than the present." After a few reflections, he says that if he may be permitted to preach at all he would like to enforce "the duty of every one of us, old or young, to give to his brethren, as he goes along—and without waiting for some future occasion for a comprehensive and monumental contribution to technical literature—the results of his observation and experience." Let this be the lesson left to us by the friends whom we have lost. Regrettable indeed is the loss of knowledge, of facts and experience, that is entailed by the silent men who pass out of life leaving no message. It may be that there are some who write too much, but for two who write more than they know there are 98 who fail to transmit the little knowledge they have gained. Man's chief ground for superiority over the dumb brute is his ability to hand down the record of his thought and work to the descendants whom he never will see; the greatest loss in the world is the waste of experience.

Metal Markets.

WE LEARN from New York that a more hopeful feeling exists and that confidence has steadily increased since the first days of the year. Consumers who in the last quarter of 1907 had taken only the metal they were absolutely compelled to purchase, either by contract or to replenish their depleted stocks, have shown more interest in the market. While prices did not appreciate at once to any noteworthy degree, there was evidence that not only had the downward movement in prices been arrested, but it was found in a number of instances that the depreciation had been carried too far. That is why, despite a greatly reduced consumption, prices advanced. This cheerful movement continued until the last days of January, when the failure of several banking institutions again reminded the public that there were many weak spots in the financial fabric. In addition, the political outlook became overcast and the last message of the President to the Congress angered the leaders of finance and tended to cause further disquiet. Since then the metal markets have drifted; there has been a feeling of uncertainty and a disinclination to operate, until the end of February has seen a state of suspense wholly inimical to trade.

As regards copper, the domestic consumers so far this year have operated in a very moderate way; the electrical industry unquestionably is poorly supplied with orders and new business is scarce. As regards present consumption, it is probable that only about 40 per cent of last year's consumption will be absorbed this year. In some other branches, as in building construction, the orders are more plentiful, but, in a general way, it is safe to say that consumption in this country is only one half of what it used to be during the recent period of prosperity. Europe has been a large buyer for the last three months, with the exception of the past fortnight, when orders stopped. During the past ten days both the Calumet & Hecla and the United Metals Selling Company, who were notably inactive, have become anxious to make sales, and large orders were taken by them in Europe at a great concession in price, namely, at 12⅝ to 12¾ f.o.b. New York. They continue to offer at these figures, so that the market is likely to recede further; but at these very low prices it is most probable that a large buying movement will be set in motion.

In spite of the large decrease in production, the accumulation of lead at the refineries does not show any perceptible diminution. This also is due in part to the enormous decrease in demand for electrical purposes, for the white-lead consumption is fairly satisfactory. On the other hand, for general building purposes, the demand ought to be better. There are sellers at anything over 3¾ cents, delivered at New York.

In spelter a very large stock has accumulated; our information indicates that between 35,000 and 40,000 tons is being held. Galvanizing has been very poor indeed, although the market has improved just lately and is likely to improve still more. Nevertheless, the largest galvanizers have not taken delivery of the metal contracted in November, December, and January. This fact seriously inconveniences the smelters. If, in spite of this, prices have hardened of late, it is due simply to the low price previously reached, for spelter cannot be purchased below 5 to 5¼ cents. Supplies of ore outside of Joplin have been practically nil, and most of the smelters had either to close down entirely or reduce their output considerably. Of late, sales have been made at 4.70 to 4.80 f.o.b St. Louis, against the lowest price of 3.90 to 4 cents early in December, but even at this figure spelter cannot be produced profitably and the smelters are compelled to purchase ores on a considerably higher basis than they can realize, and they have to do this in order to keep at least a part of their works in operation.

Thus, on the whole, the immediate outlook is far from cheerful, but it is confidently believed that the general financial condition will continue to improve and this will enable the railroads and other large industrial corporations to get money, which in turn will stimulate orders for the metals. No rapid change in the metal market is to be expected, but it seems safe to assert that the worst is behind, not in front, of us.

Personal.

S. F. EMMONS is at New York.

FRANK H. PROBERT is at Globe, Arizona.

LOUIS WEBB has returned to Cambridge, Mass.

CLAUDE VAUTIN is in the northern part of Chile.

E. L. BLOSSOM, of Butte, is here for a couple of weeks.

W. E. DEFTY is now in the Bradshaw mountains, Arizona.

F. H. MORLEY of Denver is on a business trip to Chicago.

R. K. HUMPHREY has returned to Denver from Arizona.

J. MORGAN CLEMENTS has returned to New York from Mexico.

W. L. COBB has returned to San Francisco from Gold Hill, Nevada.

ETIENNE A. RITTER, of Colorado Springs, is at Goldfield, Nevada.

W. H. SHOCKLEY was married in San Francisco on January 20.

W. R. RUST, manager of the Tacoma smelter, is returning from a holiday in Europe.

O. H. PACKER has moved back to his old quarters in the Mills Bdg., San Francisco.

C. BARING HORWOOD is returning to Johannesburg, after a short holiday in England.

GEORGE A. CARTER sailed from Vancouver for Wellington, New Zealand, on February 25.

FRED W. DANIEL, of Denver, recently with the Vidler Tunnel Co., is in San Francisco.

J. M. BOUTWELL has returned to Washington, having finished his geological work at Cananea.

R. H. BURROWS has returned to Guanajuato, having completed several inspections in Chihuahua.

W. A. HENDRYX, of Denver, has returned there from a visit to Salt Lake City and San Francisco.

N. S. KELSEY has left San Francisco to examine an oil discovery in San Luis Obispo county, California.

HAROLD TURRELL and PHILIP F. PATTERSON have an office, as mining engineers, at Penhalonga, in Rhodesia.

J. H. MACKENZIE, general manager for the Goldfield Con. Mines Co., is on a visit to San Francisco for a few days.

JESSE J. MACDONALD is on a visit to New York, where his address is with the American Trading Co., at 25 Broad Street.

FRANK OLDFIELD has returned to Los Angeles, having visited Rawhide and several other new mining districts in Nevada.

R. GILMAN BROWN is in Chile. His address is care of F. Lumley, Casilla 18D, Santiago. He will be there until the middle of April.

A. C. BEATTY has been selected by a committee of stockholders of the Montgomery-Shoshone Mining Co. to examine their mine at Rhyolite, Nevada.

JOHN HAYS HAMMOND is recovering most satisfactorily from the operation he recently underwent for appendicitis. He is at the Fairmont hotel, San Francisco.

LAFAYETTE HANCHETT has returned to Salt Lake from a visit to London, where he attended the annual meeting of the Boston Con. Mining Co., for which he is manager at Bingham.

JOS. B. TOMLINSON, of the firm of Tomlinson & Norton, consulting mining and civil engineers, of El Paso, Texas, is reporting on a gold-copper property for the Utah Mining Co. The property is 100 miles southwest of Casas Grandes, on the Aros river, in the State of Chihuahua, Mexico.

GARDNER F. WILLIAMS, ex-manager of the De Beers Con. Diamond Mines in South Africa, and formerly a resident of California, and now of Washington, D. C., arrived in San Francisco on Wednesday, on a visit to his brother Robert, who is ill. Mr. Williams only expects to remain in this city for a few days.

Latest Market Reports.

LOCAL METAL PRICES—Feb. 27.

Antimony	12@16c	Quicksilver (flask)	$45@45.50
Casting Copper	17½@18¼c	Spelter	6½@ 7¼c
Pig Lead	4.10@ 5.05c	Tin	33@34¼c

ANGLO-AMERICAN SHARES.

Cabled from London.

	Feb. 20. £. s. d.	Feb. 27. £. s. d.
Camp Bird	0 14 0 ex div.	0 13 1½
El Oro	1 1 10½	1 1 10½
Esperanza	1 3 9	1 1 10½
Dolores	1 7 6	1 2 6
Oroville Dredging	0 12 3	0 12 0
Stratton's Independence	0 2 9	0 2 6
Tomboy	1 7 6	1 8 9

(By courtesy of W. P. Bonbright & Co., 24 Broad St., New York.)

MINING STOCK QUOTATIONS—NEW YORK.

	Closing prices. Feb. 20.	Feb. 27.
Bingham Central	½	½
Boston Copper	14	14⅛
Cumberland Ely	7¼	7⅜
El Rayo	1½	1⅜
Giroux Con.	3¼	3¼
Guanajuato Con	....	2
Nevada Con	9¾	9⅜
Nipissing	6⅛	6¼
Tennessee Copper	26¼	28
Utah Copper	24¼	25⅛

(By courtesy of Hayden, Stone & Co., 25 Broad St., New York.)

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date	Electrolytic Copper	Lead	Spelter	Silver
Feb. 21	12.38	3.73	4.83	55⅞
" 22	Legal holiday. No market.			
" 23	Sunday. No market.			
" 24	12.50	3.73	4.83	55⅞
" 25	12.63	3.73	4.83	55⅞
" 26	12.63	3.73	4.83	55⅝
" 27	12.63	3.73	4.83	55¼

SOUTHERN NEVADA STOCKS.

San Francisco, Feb. 27.

Atlanta	$ 29	Laguna	1.00
Belmont	1.35	Manhattan Con	15
Columbia Mtn	20	Midway	70
Combination Fraction	67	Mizpah Extension	05
Daisy	1.05	Mohawk	.....
Fairview Eagle	50	Montana Tonopah	1.82½
Florence	4.05	Nevada Hills	3.05
Gold Bar (Bullfrog)	37	Red Top	.....
Goldfield Con	4.75	Sandstorm	29
Goldfield of Nevada	.....	Silver Pick	25
Gold Kewanas	42	St. Ives	39
Great Bend	38	Tonopah Extension	1.15
Jim Butler	42	Tonopah of Nevada	5.00
Jumbo	.....	Tramp Con	21
Jumbo Extension	40	West End	30

(By courtesy of W. C. Ralston, 353 Bush St.)

COPPER SHARES—BOSTON.

	Closing prices. Feb. 27.		Closing prices. Feb. 27.
Adventure	1½	Michigan	7½
Ahmeek	52	Mohawk	50
Allouez	27½	Nevada Con	9¼
Amalgamated	50⅜	North Butte	50⅜
Arcadian	3¾	Old Dominion	36½
Atlantic	10¾	Osceola	79
Balaklala	.....	Parrot	17⅛
Bingham Con	.....	Phœnix	50
Boston Con	14⅜	Quincy	80
Butte Coalition	20¼	Raven	.....
Calumet & Arizona	99	Rhode Island	3
Calumet & Hecla	625	Santa Fe	2
Centennial	23	Shannon	10¾
Con. Mercur	.....	Superior & Pittsburg	12¾
Copper Range	60½	Tamarack	65
Daly-West	8½	Trinity	15½
Franklin	8½	United Copper com	5¾
Granby	83	Utah Copper	.....
Greene-Cananea, ctf	8¼	Victoria	4½
Isle Royale	21½	Winona	5½
Mass	2¾	Wolverine	120

HENRY C. BEELER, the State Geologist of Wyoming, has issued a report entitled 'Wyoming Mines, 1907.' It contains a summary of conditions and progress in the copper, gold, iron, asbestos, sulphur, stone, plastic minerals, gravel, oil, natural gas, and coal industries of the State; it is well illustrated with Wyoming views.

General Mining News.

ALASKA.

(Special Correspondence.)—Nine well-defined copper lodes have been developed in the Sawtooth range, 30 miles north of Nome. The croppings assayed as high as 15 per cent. Alaska has now three separate copper belts in the Seward Peninsula, in addition to the Copper River district.——The "No. 11 above" claim on Cleary creek in the Tanana district has been sold for $135,000.——Estimates from the Seattle assay office indicate that the output of gold from Alaska during 1907 will exceed $18,000,000.——At Nome, preparations are being made for the erection of sampling works, so that quartz miners can get returns without shipping direct to distant points. The three banks of Nome have formed a clearing house and issued certificates. Currency is scarce, but the banks have ample reserves.

Nome, Feb. 1.

ARIZONA.

COCHISE COUNTY.

The Apache group of claims in the Old Hat mining district is being steadily developed by a force of 25 men. At present a tunnel is being driven through the property and it has already reached a depth of 400 ft., while a shaft has been sunk to the 150-ft. level.——At a meeting of the stockholders of the Shattuck-Arizona Mining Co. a vote was carried unanimously that the company advertise immediately for bids for the construction of an 800-ton smelter to be erected at Douglas, Arizona. Development work has been carried on steadily and shipments were made until the smelters refused to take any more custom ore.——Grading for the new Alaska mill at Congress is finished, and D. J. Sullivan, president of the United Mines Co. is in California purchasing machinery. The mill will have four Nissen stamps with concentrators and cyanide plant. The Alaska is a promising property, and is opened to a depth of more than 400 ft. and developed by 1000 ft. of drifts. The ore is of the same character as that in the Congress mine, which is about half a mile farther east. The vein runs east, dipping 30° north. Five claims comprise the Alaska group, which adjoins the town of Congress on the north. The railroad from Congress Junc. to Congress passes within a short distance of the Alaska working shaft and mill-site. The company also owns the Chicago group of claims, five miles west of the Alaska, and these will be developed later.

The Pennsylvania & Arizona Mining Co. have found ore assaying over $100 per ton in gold at their mine about 10 miles north of Morriston in the Pichaco district. The vein seems to be as wide as the shaft.

At Tombstone a compressor is being installed at the Emerald mine, where a large body of copper ore has been recently opened up. Compressed air will be used for machine drills and also for a hoist at a winze that is being sunk to determine the depth of the orebody. At the Big shaft, the work of enlarging the station on the 1000-ft. level for the installation of the pumps has been completed and the machinery is expected shortly. The pumps are handling about 4,500,000 gal. daily.

MOHAVE COUNTY.

The milling plant recently put in at the Victor mines south of Gold road is running successfully. Power is obtained from Needles. The water for the milling plant is pumped from a point near Spear's lake, a distance of about nine miles. The station is capable of delivering enough water at Vivian to supply all milling and domestic needs of that camp, as well as that of the Victor company.——Rich ore has been found by J. Carter at a depth of 60 ft. on a claim about half a mile from the Victor property.

SANTA CRUZ COUNTY.

The smelting plant of the Imperial Copper Co. at Sasco has been completed and blown in. The furnace has a capacity of 350 tons per 24 hr. and the plant is built so that it can be easily enlarged.

CALIFORNIA.

BUTTE COUNTY.

The Ophir Gold Dredging Co. has purchased the property of the Nevada Gold Dredging Co., which includes two dredgers and 250 acres of ground.

INYO COUNTY.

(Special Correspondence.)—The Keane-Wonder mine and mill are situated on the Death Valley slope of the Funeral range, 25 miles southwest from Rhyolite, Nevada. The property is managed by Homer Wilson of San Francisco. The original workings were carried on through adits, but at present the bulk of the ore is quarried from open cuts. The strike of the vein follows the trend of the range and has a dip to the south. The country rock is a schist and the vein material consists of a ruby quartz, carrying free gold running from $10 to $30 per ton. An aerial tramway about a mile in length conveys the ore from the mine to the mill, making a descent of 1300 ft. in that distance. The

Map of California.

longest span between towers is 1200 ft. The rock crusher, stationed at the upper terminal, is operated by the power generated by this gravity tramway. The mill, which handles 100 tons per day, has 20 stamps, amalgamating plates, concentrating tables, and equipment for cyanidation is being put in. The tables serve the purpose of taking up the small proportion of lead that occurs in the ore. Water for mill work and other purposes is pumped from wells by gasoline engines. Steam power is used for the mill, crude oil being used as fuel under the boilers.

Keeler, Feb. 22.

NEVADA COUNTY.

(Special Correspondence.)—Several small pockets of rich ore have been encountered in the Pennsylvania-W. Y. O. D. mine. Extensive exploration work is being carried on.——High-grade quartz continues to come from the Kenosha mine. A small force is engaged in sinking the shaft and prosecuting development work. The vein shows improvement.——Extensive exploration is going on at the Sultana group.——Excavating for the engine room and head-frame at the Midas mine has been completed, and work has been resumed on the shaft. It is expected that the orebody disclosed in the old James Bros. workings will be encountered by the new shaft within three weeks.——Limited development work is going on in the Spring Hill property. A tunnel is being driven along a large vein of low-grade ore.

Three or four men are employed.——The ore-shoot near the 500-ft. level in the Idaho-Maryland has widened to 19 in. and ten stamps are running on ore coming from this point. Several additions have been made to the working force and the mine is being energetically developed.——A splendid body of ore has been cut by the Central shaft. The 80-stamp mill is continuously running on good ore.——Work has been resumed on the Gaston tunnel, six men being employed. The adit is in 1800 ft. and it is expected to intersect the vein at a distance of 2000 ft. The tunnel will strike the ore at a depth of 3000 ft. Frank Foley is directing operations.——At the Golden Gate good ore is being developed.——It is announced that work will be resumed at the Grey Eagle mine early in March. The mine has been closed for several weeks owing to the freezing of the water-system and a break in the ditch.——The shaft at the Mountain View mine is going down in good ore. A few stamps are dropping, but the mill will not run at full capacity until spring. E. B. Miller is superintendent.——At the Omega placer mine, rich gravel is being developed. Several men are employed.——Colonel George Stone is expected to arrive in Nevada City soon to inspect the Merrimac mine, southwest of that city. It is rumored that work on the

View From Head Frame, Empire Mine, Grass Valley.

Merrimac will be resumed if the inspection is satisfactory. ——The Grass Valley and Nevada City mining districts are still over-crowded with miners. Many old residents who have been working at other trades in San Francisco and other points are returning, owing to their discharge from their positions in the cities.

Grass Valley, Feb. 24.

The fire in the Brunswick mine has been extinguished and the damage was only trifling. The lagging in the pump-station was burned and the wiring damaged. The motors and pumping machinery, however, were not damaged at all, and as soon as the necessary wiring was repaired, the pump was started and the motors and other machinery were found to be in good condition. The motors, two 40-hp. machines, were on cement foundations and some little way from the burning woodwork.

Six men have been put to work to drive the low level adit from Poorman's creek to the Gaston mine. It is now 1800 ft. long and there is still 2000 ft. to be driven before reaching the vein, which should be cut at 3000 ft. below the outcrop. An air-compressor has been installed and two shifts are at work.——The clean-up at the Idaho-Maryland mine showed a marked improvement in the grade of ore treated. The average value, exclusive of concentrates, was $22.50 per ton. The mill has 10 stamps.

A prospectus has been issued by the Iron-Clad Gold Mining & Milling Co. in which it is stated that the mine will be equipped with extensive machinery, including compressor, pumps, and a 20-stamp mill. A generator and Cornish pump are also contemplated.

PLACER COUNTY.

The dredger at the Cash Rock is finished and lies moored at the mouth of the Dardanelles canyon. The boat is 85 ft. long, 40 ft. wide, and 7 ft. deep. It is designed by Du Bois, who is operating a similar suction dredge at Middle creek, Shasta county. A diver works on the river bottom and removes the large boulders with a grappling-hook. The dredger will start work in April.——The Bellevue mine at Ophir has been bonded to Reno capitalists, who are starting development work by sinking a shaft.

SHASTA COUNTY.

A group of claims between the Niagara and Washington mines has been purchased by A. Geiser of Baker City, Oregon. A carload of tools has been shipped to Redding for development work.——While cross-cutting from the Trindath tunnel at the Washington mine, a new vein of good ore was discovered. This was about 150 ft. nearer than the vein which forms the objective of the cross-cut.

High-grade ore has been found in the Uncle Sam mine by F. Maxwell, who is working under a lease and bond. This mine ranked among the greatest producers in northern California, but recently the ore has become refractory and of low grade. The veins are wide and the mine should have an important future, if new ore-shoots can be found or the old ones worked deeper, as there is a growing demand for silicious ores at the smelters at Kennett and Coram, both within six miles.

The smelter at Delamar will be started up at the begin-

Empire Mine, Grass Valley.

ning of March. The completion of the railroad to Delamar will open up a large area covered by copper prospects. The Bully Hill Copper Co. has been steadily developing its mines during the last two years, and two 3-compartment shafts have been sunk. One is on the Bully Hill claim and this is 970 ft. deep, and the other, 800 ft. deep, is on the Rising Star. The smelter has been remodeled and now has two large blast-furnaces and one reverberatory, giving it a capacity of about 800 tons per day.——The reorganization of the Balaklala Copper Co. is proceeding satisfactorily, and all outstanding indebtedness being paid. It is expected that work will be resumed as soon as the weather improves. ——At the Mammoth smelter at Kennett the two new blast-furnaces are nearly completed and will soon be started up, together with the converter plant. Silicious ores will soon be shipped from Utah to be smelted with the basic ores of Kennett.

TRINITY COUNTY.

Hydraulic mining has been started at the Union Hill mine between Lewiston and Douglas City. The 100-ft. tunnel to convey debris from the Weaver Creek basin to the Trinity river was completed several weeks ago. Since that time a 5-ft. flume has been laid in the tunnel, through which the debris is discharged. The Union Hill is the largest hydraulic mine in Trinity county, with the exception of the La Grange, which is more extensive but not so rich.

TUOLUMNE COUNTY.

Work has been begun to drive an adit on the Ryan mine above Sugar Pine.——The United Mines Corporation is working 30 men on the New Albany. Good progress is being made on the construction of the new 20-stamp mill.

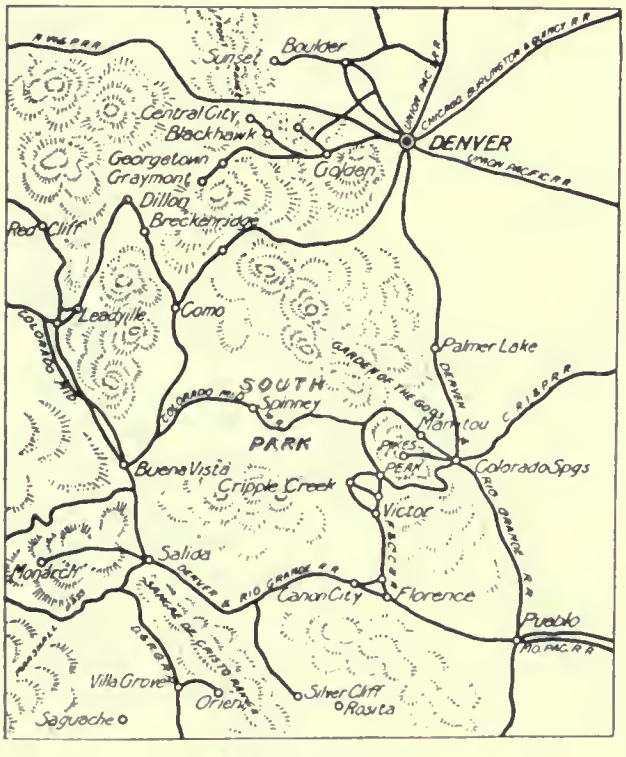
COLORADO.

CHAFFEE COUNTY.

A company has been formed to drive a low-level drainage adit to tap the mines near Granite. The tunnel will be 3000 ft. long, according to present plans. It will connect with the mines at about 300 to 400 ft. below the present workings. The tunnel starts on Pass creek and has already been driven over 100 ft. It will run in a southeasterly direction and should cut 11 known veins. The mines that will be drained are the Yankee Blade, Majenta, Robert George, New Year, Bunker Hill, Washington, Gophir, and Young America. These mines have produced about $1,000,000 worth of ore assaying about $65 per ton. None of these mines have been worked more than 250 ft. deep. The company owns six claims and has options on a number of others.——Rich ore has been found on the east drift of the Margaret mine at a depth of 50 ft. in a vein 3 ft. wide. A shipment of ore has been made to the Salida smelter, but returns have not yet been received. The mine is to be equipped with a power hoist in the spring.

LAKE COUNTY.

About 50 tons per day of zinc tailing are being shipped from the old A. Y. and Minnie dump to the zinc smelter



A Part of Colorado.

at Pueblo.——Important developments are being made in the Miller group of claims on Champion Mtn. in Lackawanna gulch. Last year a shaft was sunk from the south side of the mountain, but the work was abandoned owing to the water. Rich ore had been struck, and so a tunnel was driven from the west side of the hill, and this has reached the vein, which is richer than it was in the shaft. A mill has been erected at the mine.——Development work is being carried on at the Coronado and shipments are made regularly. The workings are all above the 600 level and water has not been encountered.

TELLER COUNTY.

Under the new contract let by the Cripple Creek Drainage & Tunnel Co. for the completion of the Gatch Park tunnel, the dimensions of the tunnel are changed from 10 ft. high by 6 ft. wide to a height of 6 ft. and width of 10 ft. The rate of progress is to be 750 ft. in each three months until the intermedite shaft is finished, after which 1500 ft. will be required until the connection is made.——H. McGarry has issued a report to the stockholders of the United Gold Mines Co. showing that 4321 tons of ore of a gross value of $123,351 were shipped last year. The net proceeds to lessees were $60,644, and to the company $26,067 in royalties. In addition the company received by settlement of the Londonderry litigation $35,156, making a total of $61,223 for the year. The money in the treasury is to be devoted to the further development of the company's territory.

Another discovery of importance has been made on the Ellen McGregor claim of the Fair Chance Gold Mining Co. on Gold hill. Shipments have been made containing as much as 309 oz. silver per ton. At present the vein is more than a foot wide and assays over 100 oz. silver per ton.

E. C. Metzaer and I. Downing have secured a lease on the property of the Jennie Sample Mining Co. Under the conditions of the lease, which is of three years duration, the shaft is to be sunk 100 ft. each year, and at least 90 shifts' work performed each month. The royalty is 2% on the net smelter and mill returns, and it is required of the lessees that they employ no men who do not hold one of the new recommendation cards of the Mine Owners & Operators Association.——Shipments have been made by L. A. Van Tilborg, who is a lessee on the El Paso Con. Co.'s estate, and by the Columbia Mining & Development Co., operating the Chicken Hawk mine on Guyot hill.

An important discovery has been made on the grounnd owned by the Cresson Con. Gold Mining & Milling Co. on Raven and Bull hills. Cross-cutting in a northeasterly direction from the 600-ft. level of the main shaft, a new vein was recently encountered, and has been traced for a length of 65 ft. and it has a width of 6 ft. The first two carloads shipped realized $110 per ton. The present development work shows an improvement in the quality of this important find.

The Royal group of mines in the Bridal Veil district has been bonded to R. D. McClelland. The group is composed of seven claims.

IDAHO.

IDAHO COUNTY.

Rich placer ground is reported to have been discovered in Baker gulch in the Elk district.——The new plant at the Buster mine has now been running a week. The tailing goes direct from the concentrators to the cyanide tanks. ——High-grade ore has been found by S. Simmons in the Hope group of mines. The ore is rich in sulphides carrying gold.

SHOSHONE COUNTY.

(Special Correspondence).—Active operations at the famous Snowstorm mine at Mullan were resumed Feb. 20, after a period of four months of inactivity. The Snowstorm closed down its main workings last November. Five smelters are now on its shipping list, comprising the Tacoma, the Granby, the B. C. at Greenwood, B. C., the Amalgamated at Great Falls, Mont., and the Butte Reduction Works, at Butte, Mont. Some ore has been going to the latter plant during the past four months, but only a small tonnage. During the interval of its cessation occasion has been taken to largely remodel and improve the plant, both at the mine and mill. At the mine a 20-drill air-compressor has been installed, to be run by electric power, and a 300 hp. motor. This is to take the place, when water is low, of the water-power compressor which has been in use in the past. At the mill four motors have been installed, replacing the steam plant. New quarters have also been completed in the meantime, equipped with steam heat, baths, laundry, dry-rooms, etc., capable of accommodating 300 men. The ore from the Snowstorm, which is silicious, is used principally for converter linings, and as such as wonted by individual smelters in limited quantity. That five of the principal plants of the Northwest have now made contracts with the Greenoughs indicates a better outlook.——The Treasure Hill Mining Co. has been incorporated in Spokane, and will take over the Butterfly group of quartz-gold claims in the Elk City gold belt of central Idaho. The properties were owned by Robert Puelz of Elk City. A valuable discovery of gold was made in the Butterfly during January, and it is looked upon as a promising property. Mining operations will be commenced

as soon as weather conditions permit the bringing in of machinery. Development consists of tunnels and shafts on each of the eight claims.

The Idaho Smelting & Refining Co. has taken an option on the Snowshoe lead-silver mine of the Libby district in western Montana, and has sent an engineer to examine the property. The Snowshoe has produced $800,000 worth of ore, but for two years it has been in litigation. This has now been settled, and the mine is ready at a moment's notice, it is said, to resume operations, the machinery and electric lighting plant having been kept in good condition. ——The smelter of the Idaho Co. situated at Ponderay, Idaho, has been undergoing repairs and enlargement preparatory to blowing in. A large supply of ores and material is now on hand, and it is expected that operations will be begun soon. The plant ran for a time last year, but was closed down after having become involved heavily in debt.

Spokane, Feb. 23.

The route selected by the St. Paul, Minneapolis & Seattle Electric Railway Co. for its new line will pass through Wallace, down to Harrison, and thence direct to Spokane. The route, which is said to be 200 miles shorter than any other from St. Paul to the coast, will not pass through Butte.

NEVADA.

ESMERALDA COUNTY.

(Special Correspondence).—It is estimated that there are 800 men now at work at the mines and mills of Goldfield. ——Frank Oliver of the Little Florence mine was recently in Salt Lake, where he secured over 100 more miners for that property. They come as machine-drillers and timbermen, and are to receive $4 and $4.50 per day, respectively. ——The lessees on the Little Florence have a lease that runs 68 days longer. When it expires their employees will doubtless be received by the Consolidated company. The Utah miners, who are out of work, seem to be glad of the chance to get work, and those who come renounce allegiance to the Western Federation of Miners.——It is reported that the Allis-Chalmers Co. has secured the contract to furnish the machinery and equipment for the mill to be erected by the Goldfield Con. Mines Co. The proposed mill is to have 100 stamps, with amalgamating plates, concentrating tables, and cyanide equipment.

Goldfield, Feb. 24.

A new vein has been discovered in the 900-ft. level of the Belmont mine at Tonopah. The width of the ore is not known, but it assays about $50 per ton.——Shipments for the week ending Feb. 15 in the Tonopah district amounted to 4125 tons. The Tonopah Mining Co. shipped 3113 tons to Miller; Belmont 895, and McNamara 117 tons. ——On the Copper Spot claim in the Golden Arrow district rich ore has been found in a vein with a strike northwest and dipping southwest. The ore is 6 ft. wide and assays $40 per ton.

LINCOLN COUNTY.

On the Esther claim at Searchlight another vein of rich ore has been found, 300 ft. north of that recently discovered.——The Chiquita Con. is increasing its force. It is stated that the ore improves in quality near a fault which has been recently encountered.

NYE COUNTY.

(Special Correspondence).—The Bonnie Claire mine and mill were closed down a short time ago, chiefly because there was no market for the ore and concentrate. In the meantime the property has been placed in the hands of a receiver. The suspension of operations is considered only temporary. The mill is equipped for amalgamation, concentration and cyanide treatment. The ores carry gold, silver, and lead, the last named being recovered on the tables in the form of a high-grade concentrate, being partly galena and partly oxidized ores. The mill is at Bonnie Claire station on the L. V. & T. railroad, and the mines are 8 miles away. The mines are in four groups in close proximity to one another—the Rattlesnake, New Century, Eva May, and Corbet. The mine is extensively developed by adits and shafts. F. H. Vahrenkamp is general manager.

Tonopah, Feb. 23.

(Special Correspondence).—The Combination mill of the Goldfield Con. Mines Co. is treating 90 tons of ore per day, recovering over 92% by amalgamation, concentration, and cyanidation. The ore contains about three ounces of silver per ton and the rest in gold. Since A. G. Kirby took charge of the mill the method has been considerably modified. From the crusher the ore passes to the 20 stamps reduced to 1½-in. size, together with much fine material. The battery screens are 16 mesh, through which the pulp passes to plates, thence to tube-mills which pulverize to 100-mesh. Then it is pumped up to cone classifiers, the overflow from which is again passed over plates. That from the bottom of the classifiers is reground in the tube-mills, then elevated to classifiers again, the overflow from this second classification passing to the lower part of the mill over canvas tables, thence to settlers, and then into the agitating tanks, where it first comes in contact with cyanide solution; the underflow product of this second classification goes to Frue and Triumph vanners for concentration, the tailing from the vanners being conveyed to the sand tanks for cyanidation. The slime from the agitators is passed through Butters vacuum filters, thence to a Smith-Valie filter-press for taking up the flocculent slime before passing the solution to the precipitating boxes. In the slime tanks centrifugal pumps are used to agitate the slime. The concentrate consists of a complex sulphide including iron and other base metals.

Goldfield, Feb. 21.

(Special Correspondence).—The Johnny mine and mill are situated 12 miles from Armagosa station on the Las Vegas & Tonopah railroad. The mine is opened by an incline, which follows the dip of the vein to a depth of 700 ft. with 7 levels running from it on the vein. The mill contains 8 Nissen stamps with amalgamating plates. The ore is free-milling and averages about $15 per ton. A gyratory crusher reduces the ore to the proper size for the stamps. The power is supplied by three Fairbanks-Morse gas engines that use crude oil for fuel. The cost of this is 10 c. per gal. and it is found to be more economical than distillate or gasoline. There is one engine each for the mill, air-compressor, and hoist.——The Montgomery-Shoshone mill at Rhyolite is treating 250 tons of ore per 24 hr. and shipments of high-grade ore make up a total production of 300 tons per day. The hoist over the 600-ft. shaft is operated by steam power, crude oil being used as fuel, but the air-compressor and mill machinery are run by electric power transmitted from the power plant at Bishop Creek, California. A 15 by 24 Blake crusher reduces the ore to 1-in. size, and it is then treated by three sets of rolls, each 14 by 42 in. diam., the first set crushing to ⅝-in., the second to ¼-in. size, and the third to 16-mesh. The product from the rolls is elevated and sized by revolving trommels, the oversize in each case being re-ground until all is reduced to at least 16-mesh. Much of the ore consists of an oxidized material and 80% of it will pass a 40-mesh screen after grinding in the finishing rolls. After being reduced thus the material passes over amalgamating plates and thence to two Dorr classifiers which separate the slime and sand. The sand from these classifiers passes to Wilfley tables and the slime passes through a settling cone to Frue vanners. The resulting concentrate is largely an oxide of iron, carrying gold with a little sulphide. The silicious middling and tailing from the tables pass to sand vats for leaching and the tailing from the vanners is cyanided in agitating tanks, the final slime being passed through Butters vacuum filters. The metal in the solution is precipitated in ordinary zinc boxes. There are five sand-leaching vats, each 36 ft. diam. by 6½ ft. deep, and the agitating tanks are 28 ft. diam. and 16 ft. deep. Blaisdell excavators are employed in discharging the sand vats and mechanical agitators are used in stirring the slime. The ore of this mine consists of rhyolite and quartz, carrying gold and silver, and the methods of amalgamation, concentration,

and cyanidation result in a high saving. Donald B. Gillies is manager and B. W. Turner is superintendent.

Rhyolite, Feb. 23.

Tungsten is reported to have been found in the New Florence district. A number of large lodes are said to occur.——The Gold Bar has made the first clean-up at the mill. The capacity of the mill is 45 to 50 tons per day and the ore assays $15 per ton.——The Montgomery-Shoshone mill has shut down for some alterations. Amalgamation will be discontinued and the ore treated by concentration and cyanidation only. Development work proceeds steadily and about 45 tons of high-grade ore are shipped daily.——A six-drill compressor and machine-drills have been ordered for the Homestake mine. A full force has been at work at the mill since the weather improved.

A cross-cut is being driven on the M. & M. lease on the Great Western at the 140-ft. level. The ore on the 90-ft. level averages $25 per ton.——The framework for the mill of the Round Mountain Reduction Co. is completed and the works should be ready to receive ore within four weeks. Water will be secured from wells 4000 ft. away and a head of 188 ft. will be secured.

NEW MEXICO.

SOCORRO COUNTY.

(Special Correspondence).—The Last Chance mine of the Ernestine Mining Co. of Mogollon has just opened 12 ft. of $25 ore on the 11th level west, 1000 ft. below the surface. This ore contains equal quantities of silver and gold. This property produced over 50% of the gold and silver sent out from the Territory during the last two years. The present ore reserve guarantees a steady production for at least five years. The ore is treated in a 20-stamp mill, this being followed by concentration and cyanidation, the sands having a six-day leaching, while the slimes receive a thorough agitation and are then sent to the Moore filter plant. Fifty men are employed on this property. E. Craig is president. ——The Top Mining Co. have equipped their shaft with a 25-hp. gasoline hoist and a 10 by 12 compressor. The shaft is down more than 200 ft. in ore of milling grade.——Abe. Peterson, one of the owners of the Iron Group, is running in a tunnel from the White Water side to connect with the shaft on the Iron Bar. Some high-grade ore has been taken from this shaft.

Socorro, Feb. 21.

At the Laura mine in the Steeple Rock district shipments of rich ore containing $1200 per ton have been made. Some tons of this ore were stolen and hauled away by teams at night and shipped to the smelter, but the thieves left the country before getting payment from the smelter. ——The discovery of an outcrop of rich ore 2 ft. wide is reported at a point 90 miles southwest of Wickenburg and 12 miles west of Mesquite Wells.

OREGON.

BAKER COUNTY.

Development work is progressing rapidly at the Iola Gold Mining Co.'s mine in the Greenhorn mountains. As soon as the weather improves, a compressor will be installed and the work of driving the adit continued. This is now 350 ft. in length and will be driven 1400 ft., when the vein should be found at a depth of 800 ft. from the surface. The deposit is a large one and the ore is of good milling grade.

UTAH.

JUAB COUNTY.

Developments on the 1800-ft. level in the Lower Mammoth mine show that a large body of rich silver-lead ore occurs at that depth. It has been followed for 125 ft. and its limitation has not yet been reached. The other dimensions cannot be found until the shaft is sunk farther, owing to the water.

SUMMIT COUNTY.

The annual stockholders' meeting of the Daly West mine was held in Denver recently and the following particulars published: The output had a net value of $771,679. This included 673,890 lb. copper, 8,086,456 lb. lead, and 1,042,062 oz. silver. Dividends amounting to $378,000 were paid, and the cash on hand is $313,967. The average assays of the crude ore were as follows: Silver, 43.13 oz.; gold, 0.0423 oz.; lead, 13.43%; copper, 1.4%, making an average total value of $28.51 per ton for the year's output.

WASHINGTON.

FERRY COUNTY.

The ore being shipped from the Insurgent mine assays about $35 per ton. The drift has reached a point under the shaft, which was sunk as far as the Lone Pine adit. G. B. Dennis is president of the company. The water in the Lone Pine workings has been lowered 40 ft. There are about 300 ft. of drifts, besides raises and stopes, to be drained, which will require two weeks of pumping.——The No. 3 adit of the Copper King mine is in 273 ft. and is to be driven about 100 ft. farther.——The Colville Mining & Smelting Co. has had two Merberry rotary furnaces hauled to the South Half group at Park City.——The No. 3 Mountain Boy adit is in 270 ft. The No. 4 adit cut stringers of ore when 600 ft. from the portal, but as yet the vein has not been found.——The Summit adit is in 50 ft. A. C. Cook is superintendent.——An important but unexpected discovery of ore containing gold, copper, and lead is reported on the Byrne group in the Keller district. The ore was found in the adit of the Silver Creek Mining & Milling Co. at 40 ft. from the portal.——Another valuable find has been made on the Papoose claim in Keeno gulch, a mile north of the Congress mine. A tunnel was driven 70 ft. and 20 ft. of it is in heavy galena ore. The ore has been found within 150 ft. of the boundary between this claim and the old Roaring Eagle claim. The discovery on the Papoose was made by J. A. McJunkin, superintendent of the Paymaster mine.——The Silver Tip Con. Mining Co. owns ten claims on Iron Mtn. and Mineral hill. A vein containing quartz with gold and silver and about 4% lead has been opened by cuts and an adit. Work has been resumed in an old adit and a good body of ore found at a depth of 50 ft. A lower adit has been started and development will be continued to find the ore at greater depth. The ore is siliceous and contains argentite, galena, and mispickel. Some samples assayed as high as 257 oz. silver and $24 gold per ton, and 7.2% lead. The company is planning to put up a compressor plant and use machine drills for development.

STEVENS COUNTY.

In the Globe mine a body of ore was encountered over a month ago, and this is being developed by drifting on the vein.——A body of ore 6 ft. wide has been found on the 100-ft. level of the Defender mine and a drift has been started on it.——Regular shipments are being made from the First Thought mine to the smelters at Tacoma and Northport.——A group of 20 claims on First Thought hill will be actively developed by New York capitalists.—— Work has been resumed on the Trojan mine. Before stopping work a vein was discovered in adit No. 3, and now this will be exploited and the adit continued about 500 ft. to reach the main vein. L. Larsen of Orient is superintendent.

CANADA.

BRITISH COLUMBIA.

At the Granby smelter the entire eight furnaces are again in operation. Two of them were out for several days last week while some minor repairs were going on, both at Phoenix and Grand Forks. During that time the tonnage was lessened somewhat, but the Granby mine has already shipped over 100,000 tons of ore this year.——A deep-level adit for the drainage of the mines near Phoenix is under consideration. The work would probably be started from Greenwood and carried on to Phoenix, if the present plans mature.

The Snowshoe mine in Phoenix, operated by the Consolidated Mining & Smelting Co., has just shipped the first carload of copper ore since the closing of the property last November.——The following shipments were made from the Rossland mines last week: Centre Star, 3060 tons; Le Itol, 1599; Le Roi No. 2, 743, and Evening Star, 30 tons.

Special Correspondence.

LONDON.

Zinc Corporation.—The Elmore Process.—Cornish Mining and Mr. Collins.—Discoveries in the Waihi and Great Boulder Mines.

The erection of the Elmore vacuum plant at Broken Hill for the treatment of zinc tailing belonging to the Zinc Corporation is now practically complete and before long some very interesting results should be obtainable. It will be remembered that last summer the Zinc Corporation found itself in an acutely critical condition. With deference, I am bound to say that this crisis was due to the precipitate policy of the directors and managers, who embarked on this enterprise without full consideration. Stacks of tailing were bought before the process to be adopted was settled upon, and the payments became due long before the Corporation got to work. This was what crippled the resources of the company. The fact that two flotation processes were tried and proved to be valueless is no sort of reproach to the sagacity of those responsible. Rather is credit due to them for enterprisingly testing all the processes on a practical scale, and for dropping them so quickly when they failed to give results. From the directors' point of view it has been urged that these great purchases of tailing before the company was ready to treat them were made with the best intentions, namely, to secure the supply before anybody else. I believe that the Elmore process would have been adopted earlier if the inventor had been on the ground. As it was, the Elmore plant was there without anybody to erect or explain it, whereas the representatives of the other two processes were on the spot and able to advocate their cause. The Elmore plant consists of 16 units, each able to treat 30 tons per day. The one unit that Frank Elmore put up has been working continuously for the last few months, and gives excellent results. The financial condition of the Corporation is still in an uncertain state, and the directors are urging shareholders to take up some more preference shares. Last summer the crisis in the company's affairs was so serious, and the outlook so dreary, that fresh capital could only be raised on very onerous terms. Preference shares to the amount of £182,000 were created. These entitled holders to the whole of the profits until 100% had been paid on them, and subsequently to a cumulative preferential dividend at the rate of 20%, with the right to participate pro rata with the ordinary shares in the division of any further profits. Of these shares 76,000 were taken up by shareholders and 32,000 placed elsewhere. The directors are now trying to dispose of the remainder, by offering a call at par for a similar number during the next six months to anybody who will take some now. The directors hope that by that time the value of the preference shares will be better appreciated. The anxieties of the directors will not, however, be over when the Elmore process is at work, for the concentrate is not exactly popular among zinc smelters, and the method of their treatment or disposal will require careful thought.

In a recent issue you printed some remarks by me on the re-opened Cornish mines. I mentioned that the best and cheapest work in this direction was being done by J. H. Collins at Wheal Kitty & Penhalls in the St. Agnes district. The half-yearly results of this company have been published this week, and some details may be very interesting. The present company was formed in October, 1906. The nominal capital is £35,000, in 70,000 shares of 10s. each, but only 44,000 have been issued, of which 24,000 went as purchase price for the property and 20,000 have been subscribed for in cash. The company took over the crushing and dressing plant from the previous owners, and little money was spent in this direction. Most of the cash raised on the flotation of the company has been expended on shaft-sinking and development of some of the orebodies. During the second half of 1907, 54½ tons of concentrate were sold, realizing £5228, the price obtained being high, showing that the concentrate is of good quality. The current expenses amounted to £4500, thus leaving a small profit on the half-year's work. The company is considering the advisability of issuing further shares for the purpose of pushing the development of the mine. In my own judgment the mine offers an excellent scope for investment, and I hope that shareholders will courageously support a scheme for opening it and providing it with a suitable outfit.

Map Showing Position of Broken Hill.

Mr. Collins is a genuine Cornishman and looks for his mine before he puts up a plant. Some of those who have recently re-opened properties in Cornwall have followed the opposite tack and erected a fine modern plant before making a thorough examination underground.

Announcements of important discoveries in two of our leading gold mines have been made this week. One is at the Waihi in New Zealand, a mine which not only overshadows everything else in that country but takes rank with the greatest mines of the world, on the score both of its extensive character and its good management. The deposit is not a restricted one, nor do the veins tend to pinch in depth, as yet. On the contrary, exploration work continues to open up larger reserves of ore. The present news relates to a remarkable development in the Edward lode at the No. 8 level. This orebody was first discovered in 1906, and it is a sort of west extension of the Empire lode. According to a circular issued in October last, the lode had then been opened up for 445 ft., the average width being 9½ ft., and the gold contents 11 dwt., with 2 oz. silver. The news circulated this week states that the driving has been continued for another 232 ft., and that the lode has increased in

width and contents in an unusual manner. Along the face, the sampling shows the ore to vary from 15 dwt. to 2¾ oz. At two points cross-cuts have been driven through the vein, at one of which the vein is proved to be 48 ft. wide, averaging 1½ oz., and at the other 65 ft. wide, averaging 2¾ oz. per ton. It is no wonder therefore that shareholders are in complacent mood and that there is a flutter in the shares. The other important news referred to is the announcement of an extensive discovery in the Great Boulder Proprietary at Kalgoorlie. Here the 2200-ft. level has opened up well. Over a distance of 300 ft. the ore averages 29 dwt., and at the point of working it carries 70 dwt. per ton. The cabled information says nothing about the average thickness, but we may take it for granted that the vein is of the width usually found in this district. The discovery of a rich body of ore at so great a depth is an important event at Kalgoorlie, and it should have some influence on the economic conditions ruling in that camp. For instance, it may cheer Mr. Herman Landau, whose gloomy forecast of the future of West Australian mines I referred to in a recent letter.

Since my name appeared on your editorial page, as representative of the MINING AND SCIENTIFIC

Rawhide, Nevada.

PRESS in London, I have received a large amount of correspondence from your readers in the United States. I grieve to say that I am considerably out of pocket in consequence, for 95% of the letters were insufficiently stamped. It is a standing grievance in England that letters from America hardly ever bear sufficient postage. For many years it has been taken as a small, but none the less true, sign of a happy-go-lucky method of conducting business affairs which is characteristic of the American. Nature has endowed the United States with vast animal, vegetable, and mineral resources, and the country could not help but be rich. Unfortunately the inhabitants attribute their wealth, not to the prodigality of nature, but to their own superior wisdom, shrewdness, and ability. The fact of the existence of a financial stringency shows that there is something wrong that more than counter-balances the natural advantages of the country. So, please, readers of the MINING AND SCIENTIFIC PRESS, begin to reform your business methods by properly stamping your foreign correspondence, and no longer give yourselves a bad character abroad. The above remarks look very unkind, but they are not a quarter as bad as the usual American criticism of British methods and institutions. Another point with regard to the correspondence that I have received: Most of it consists of invitations to participate in mining deals or to place shares in American corporations in London. I may as well say at once that I do not undertake this class of business, financial operations not being in my line.

RAWHIDE, NEVADA.

Latest News.—Extent of the District.—Good Widths of Milling Ore.

The first location on Baloon Mtn., on which some of the best claims are situated, was made on February 17, 1907, and stakes were driven on Grutt Hill to the north during February and March, 1907. The results of prospecting were kept quiet until certain options and leases had been secured by those who recognized the possibilities of the district. It was not until last autumn that prospectors and fortune-hunters spread all over the district. Last October there were not more than 150 men in the camp, while the recent influx has been so rapid that it is difficult to predict from week to week just how many are here—between 3000 and 4000.

The district is just in Esmeralda county, but near Churchill, so much so that most of the early locations are stated as being in the Regent mining district of Churchill county. The mineralized porphyry extends six miles north and south and two miles from east to west, or about 12 square miles, and it is all covered with locations. The surface shows very little quartz float; near the camp of Rawhide there are boulders of quartz, evidently the result

A Prospect at Rawhide.

of replacement in the porphyry dikes characterizing the district. The mineralized district is an immense uplift crossed by dikes of iron-stained porphyry which, where a replacement of feldspar by silica has taken place, has become mineralized with gold and silver. The iron stain is due to oxidation of the pyrite. The iron stain is the prospector's guide, for gold appears to accompany it through the porphyry. The white talc gouge often is rich. These mineralized dikes are from 20 to 60 ft. wide with streaks of high-grade ore, the whole mass (in some already developed) being a good grade of milling ore. Good ore has been found in half a dozen places from Balloon hill westward as far as the McMann group, about 2½ miles in a direct line. Here a 200-ft. cross-cut has cut the dike, showing about 3 ft. of ore, which when picked is said to be rich enough for shipment. The remainder of the dike is milling ore. These streaks of high-grade stuff often appear as separate veins in a dike, but I think they are due to replacement along shear-lines in the dike. To the southeast the porphyries are capped with basaltic lava. Placer gold has been found in the vicinity, but, owing to the limited amount of erosion and the fact that cloud-bursts (which are characteristic of the desert) are so violent, everything in the canyons is swept onto the desert mesas and spread over a wide area, so that the amount of placer gold to be found is not likely to be large. The gold is extremely fine in the ore and would be hard to save by washing in pans or sluices, although pieces worth 60 or 70 cents have been reported found.

DENVER, COLORADO.

New Rates on Lead Ores.—Activity in Clear Creek and Gilpin.—Oil Strike.—Promoters and Newspapers.—Leadville News.—Progress at Cripple Creek.

The new schedule of rates for the lead ores of Boulder, Clear Creek, and Gilpin counties reeently issued by the Chamberlain-Dillingham Ore Buying Co. at its various samplers in the district is having the desired effeet. Work is being pushed on all the produeing mines with increased vigor. At Central City the Golden Sun Co. is advaneing its main adit through very hard rock at three feet per day. This adit is to be double-tracked and used both as a drainage and transportation outlet. It is now in 900 ft. and when eompleted will be one of the important enterprises of its kind in the district. The Paolo mine in Leavenworth guleh is under bond and lease to Denver and Kansas City parties. They have installed a new hoisting engine preparatory to sinking and development work. The Quartz Mill property in the same guleh has been unwatered by Idaho Springs miners and arrangements made to sink the shaft another 100 ft. The lessees operating on the East Leavenworth mine near Russell guleh have begun aetual mining after nearly a month spent in timbering the shaft, repairing the buildings, and installing the neeessary maehinery. At Idaho Springs, work has been resumed on the lateral leading from the Newhouse tunnel along the Saratoga vein to a point direetly underneath the shaft. At this point a station will be eut and a raise made to the shaft. All the ground in the Speeie Payment mine above the fifth level has been leased to T. J. Johnston and associates of Idaho Springs. It is the purpose of the lessees to sub-let bloeks of ground on favorable terms so that the mine may be brought to full production as soon as possible. The Ward mine, whieh has been unwatered lately for sampling, is being allowed to fill with water again. This is a large low-grade proposition and would require a large produetion to make it profitable. The engineer's report has not been eompleted.

A ease of more than usual interest has just been appealed to the Supreme Court. The treasurer of Boulder county sold the St. Louis mine, mill, and tramway for unpaid taxes of 1900. J. T. Bottom, one of the heaviest stockholders in the company, paid the taxes and seeured the title. In the following year Bottom allowed the taxes to go by default, and they were paid by L. S. Young, who then applied for a tax-title. Mr. Bottom interfered with a petition for an injunetion restraining the County Treasurer from exeeuting or delivering a tax-deed to Young. When the ease was tried before Judge H. P. Gamble on Nov. 29, 1907, the petition for a permanent injunetion was denied but the temporary injunetion was allowed to remain in force until the Supreme Court eould render a decision.

The reeent strike of natural gas at Fort Collins has aroused oil prospeetors in the eastern part of the State. The Pierre formation in El Paso county is being explored again at the Donovan ranch three miles southeast of Colorado Springs. The eontraet for the drilling has been let to N. West of Denver. ——W. W. Degge, a Boulder promoter, and his various corporations are defendants in a suit before the District Court of Denver. The complainant is the Mining Investor Publishing Co., proprietor of the *Mining Investor*. It is alleged that Degge connived in the theft of the subscription lists of the *Mining Investor*. The ease is directed against Degge, the Wellington Association, the Wellington Investment Co., and the Wellington Realty Co. The *Daily Mining Record*, of Denver, which has been advertising these companies extensively, excluded the advertising matter of these companies as soon as the facts were known. This is all well enough after all the possible damage has been done. If the *Daily Mining Record* is really working for the good of the mining industry, it should require some proof from the companies that it advertises that they are legitimate business enterprises. The same is true of the *Investor*; both are incubators of wild-eats.

Leadville is rejoicing because the Tuscan mine, one of its steady producers, is again in the aetive list. A small force of miners has been put to work and the force will be increased as the market conditions permit. The Dinero Co. has eompleted the examination of its property in the Sugar Loaf district and is now advaneing its adit into the mountain as rapidly as possible. The adit is in 2255 ft. and has to be extended 1220 ft. more before it comes under the old Dinero shaft. This shaft, although it showed good ore, had to be abandoned on aeeount of water. The Modoc lease on Carbonate hill has been taken over by a new set of lessees, who have retimbered the shaft for the first 400 ft. After eompleting the remaining 300 ft. of timbering, the lessees will begin development on the known orebody.

Cripple Creek has been favored with another reduction in freight and treatment eharges. The U. S. R. & R. company has announced a $3.50 rate on ores of $8 and under. This, of eourse, will stimulate the produetion of low-grade ore, and add to the troubles of the transportation companies, whieh are working about to their limit with the present tonnage. The direetors of the Anehor Co. are making a strenuous effort to redeem their property, whieh was sold under sheriff's exeeution last Oetober. The debt is only $3800. The property is well situated. The Deep Drainage Tunnel is being pushed rapidly under the Carlton traet. The best reeord yet made for a single day is 12 ft. The marked increase in the rate of advanee is another illustration of the advantage gained in driving an adit in hard ground by making it wide enough to allow the eut-holes to get a good lift. The width of the adit has been increased under the present eontract from 7 to 10 feet.

GOLDFIELD, NEVADA.

The Consolidated Mines.—Combination and Mohawk Shafts.—Character of the Ore.—The New Mill.—Scale of Wages.

The Combination shaft of the Goldfield Consolidated Mines Co. has three compartments, and connects with six working levels at 80, 130, 180, 230, 280, and 380 ft., respeetively, from the surface. The greatest development appears to be on the two deepest levels, though the workings on the higher levels are extensive, with mueh ore exposed in open stopes. The ore is oxidized down to the 180-ft. level, below which it consists of iron pyrite in a hard quartz gangue. The sulphide appears to grade from the lighter form to the heavier iron pyrite, the gold being disseminated through it in minute partieles, usually invisible. In breaking off the oxidized ore a vast quantity of fine material results, and this is true to some extent of the sulphide stopes. At present air-drills are in use only on the lower levels. The open stopes and reserves show the orebody to range from 15 to 40 ft. in width. The bottom level of the Combination and the 350-ft. level of the Mohawk correspond to eaeh other, the two mines being eonnected at this level. At the Combination a force of about 100 men is employed in mine and mill, and enough ore is being hoisted to keep the mill in operation. In the meantime development is being pushed and ore is being blocked out.

The Mohawk, one of the big mines of the Goldfield

Consolidated, has a 600-ft. working shaft, with three compartments, the levels being at 250, 350, 450, and 600 ft. The Mohawk lode has a strike to the northwest and a dip of 45° east. The shaft cuts through the lode at the 350-ft. level. The ore lies within a dacite zone, the hanging wall being well defined. The width of the zone of mineralization is 360 ft. on the 450-ft. level, but not so wide on the 350. Besides the varying mineralization of the lode as a whole, there are transverse fissures cutting through it, carrying narrow streaks of exceedingly high-grade stuff; there are also well defined chimneys of ore of the highest grade. In some of the worked-out chambers on the upper levels the character and extent of these chimneys were well demonstrated. A winze being sunk from the 450-ft. level on one of these high-grade shoots is to be continued down to the 600-ft. level. This winze follows the ore-shoot. The gangue is a brecciated quartz, carrying the iron

The Town of Rhyolite, Nevada.

pyrite with which the gold is associated. The high-grade streaks, however, carry the gold chiefly as a telluride. The prevailing opinion is that the gold in the sulphide is largely in a free state, and that it is released by fine grinding. In support of this idea it is stated that on the plates following the stamp-batteries the percentage of recovery by amalgamation is low, while the recovery on plates below the tube-mills is comparatively high.

About 90 men are employed at the Mohawk, developing and blocking out ore. The intention is to be ready to hoist and send to the mill about 500 tons per day as soon as the mill is complete, three months hence. It is said, also, that the plan is to make a mixture of all grades of ore and send it to the mill, except the phenomenally high-grade streaks. It is claimed that the tonnage of ore in the mine, blocked out and accessible, is sufficient to keep the mill supplied for years. The ground formerly under the Hayes & Monnette lease, on the upper levels, still contains large pillars of rich ore and important segments of the lode. Development on the 600 level has just been commenced.

The hoisting is being done by electric power at present, though a new double-drum steam hoist is being installed and will soon be ready. It will have a rope speed of 800 ft. per min. The power is to be supplied by two 100 hp. steam boilers, under which oil will be used as fuel. In a separate new building are two Nordberg air-compressors, each having the capacity of 1500 cu. ft. free air per minute, and electrically driven; also a machine-shop and a distributing system for the electric power.

The company has started a new shaft on its Clairmont ground, 1000 ft. east of the Mohawk shaft, which has reached a depth of 300 ft. Eventually the plan of centralizing the hoisting for the entire group will be carried out. The work on the new 100-stamp mill has commenced. The Allis-Chalmers Co. is to supply machinery for crushing, amalgamating, concentrating, and re-grinding; and the equipment for the cyaniding departments will depend upon tests being made by C. W. Merrill.

On the operating staff of the company are the following: J. H. Mackenzie, general manager; E. Hampton, general superintendent; D. C. Wilkinson, engineer; A. G. Kirby, mill superintendent; William Campbell, superintendent of the Combination mine; A. J. Canavan, superintendent of the Mohawk; H. D. Trenam, superintendent of the Red Top and Jumbo mines; John B. Fleming, mechanical and construction engineer. F. L. Bosqui is consulting metallurgist of the company.

A branch railroad is being built to the mill-site, which is near the Sandstorm mine and about two miles from the Mohawk. The company has at this time about 300 men employed at its mines and Combination mill. The wages it pays are as follows: Miners, $4; machine-men, $4; helpers, $3.75; trammers, $3.75; shovelers, $3.75; timber-men, $4.50; pump-men, $4; head blacksmith, $5.50; tool-sharpeners, $5; blacksmith helpers, $4; top-men, $3.75. This is the wage scale adopted by the Goldfield Mine Owners' Association, and while there has been a prospect on the part of one or two lessees to advance the pay of the miner to $4.50, the management of the Consolidated company, the largest employer of labor, announces its determination to stand by the above scale.

RHYOLITE, NEVADA.

The Homestake Group.—The Mine and Mill.—Gold Bar Mine.—Start of New Mill.—Tramp Consolidated.—The Mayflower.

The Homestake-King Consolidated Bullfrog Co. has developed and is equipping a mining property six miles northwest of Rhyolite. The principal lode of gold-bearing ore strikes northwest through a rhyolite country, and has a dip of 76° west. Two shafts have been sunk on the vein, one an incline and the other a vertical shaft, 1300 ft. apart. Both shafts reach a depth of 500 ft. and are equipped with gasoline hoists. The development aggregates some 3400 ft. of work, consisting of shafts, raises, and drifts. The plans contemplate the sinking of a three-compartment working shaft at a point between the two old shafts, opposite the mill now under construction. The ore consists of quartz in an altered rhyolite, with free gold finely disseminated through it, and a little silver. Tests indicate that the bulk of the yield in the mill is obtained from the slime, rather than from the coarse sand. On the 200-ft. level thorough sampling by A. G. Cadogan, the superintendent, showed a vein 50 ft. wide, carrying ore averaging $14 per ton; similar sampling on the 300 level showed the vein to be 15 to 20 ft. wide, the ore averaging $12 per ton; samples from the 30-ft.

vein on the 400 level gave an average of $23 per ton. Rich streaks are said to run from $40 to $100 per ton. The foot-wall is well defined, but the hanging wall is not so definite, the vein-filling shading into the country rock on that side. Development on the strike of the lode for nearly 2000 ft. demonstrates that there are two ore-shoots, both pitching to the north. The mill, under construction, which is to be ready in May, is being erected and equipped by the Colorado Iron Works, represented on the ground by W. B. Milliken and J. F. Gibbs. The plant was designed by John E. Rothwell, assisted by Mr. Milliken. The equipment comprises a McCully crusher, 25 stamps, 1050 lb. each, the battery screens to be 18 mesh, of No. 24 wire. Below each 5-stamp battery is a 12-ft. amalgamating plate in three sections. The pulp is to pass from the plates to Dorr classifiers. The slime from these passes through settling-tanks to Hendryx agitator vats in which cyanide solution is introduced. The sand from the Dorr classifiers is conveyed to tube-mills, of which there are three, each 3 ft. 9 in. diam. by 15 ft. long, having steel lining of the El Oro type. The pulp from the tube-mills passes over a second set of amalgamating plates, thence to Dorr classifiers again. The slime from the latter goes to the agitator vats and the sand is re-ground in the tube-mills and passes thence to the Hendryx agitator, except that a portion of the coarser sand may be cyanided subsequently. The final slime treatment is in Butters filters. Thus it is seen that provision is made for almost all-slime treatment. It is believed that 80% of the saving will be by amalgamation. Tests pretty well indicate that by amalgamation and cyanide a total extraction of 94% can be made. It is figured that the ore will average $15 to $18 per ton. The mill will be operated by electric power. The president of this company is B. D. Milan of Dallas, Texas, with Con. O'Donnel as general manager, A. G. Cadogan superintendent.

The Gold Bar Mining Co. has a well developed mine end-lining with the Homestake group. The Gold Bar was the earliest location in this part of the district and has been for three years under the superintendency of L. E. Bedford. J. P. Loftus of Goldfield is president, J. R. Davis general manager; L. M. Louis is construction engineer, under whose direction the mill was built; W. H. Royston is in charge of the mill. The mine is opened by means of an incline shaft 550 ft. deep, with stations at the 50, 150, 250, 350, 450, and 550-ft. points. Levels on the vein from the second, third, and fourth of these stations aggregate over 5000 ft. of work. Stopes have been started above these levels. The vein, as exposed on the 150-ft. level, is 5 to 6 ft. wide; that on the 350 level being 30 ft. in width. The character of the ore in this mine is similar to that in the Homestake, as described above. A general average is placed at $15 to $16 per ton. The hoisting is done by gasoline engines. The mill has a crusher, 10 stamps, and a Huntington mill. Following the stamps are plates, all the pulp passing over the latter being re-ground in the Huntington, this being followed by a second set of plates. The mill machinery is operated by electricity from the lines of the California Power plant. The mill has been operating but a week or two and results are proving that the ore is ideal for treatment by amalgamation. Water is pumped from springs four miles away to a tank near the mill, electric pumps being used.

The Tramp Consolidated Mines Co. has a group on Bonanza Mtn. overlooking the town of Rhyolite. It is the consolidation of the Hobo, Tramp, Eclipse, and Denver claims, and is being developed through the Denver adit. C. N. Gardner is the superintendent. There are three adit levels, the lowest of which attains a depth of 600 ft., the workings on the three levels being connected. The vein is said to have an average width of about four feet.

The Mayflower mine, superintended by Robert Smith and situated five miles north of Rhyolite, is opened to 500 ft. by an incline shaft and drifts on the vein at various levels, showing a well-defined orebody, carrying free-milling gold ore in a rhyolite-quartz gangue. Eventually a mill will be built. The Bullfrog-Pioneer Mining Co. has a property in the same part of the district, a portion of it being under lease to the Bullfrog-Pioneer Leasing Co., managed by G. K. Vaughn. Development shows a vein 40 ft. wide in places, with 20 ft. of ore, opened by levels from the surface. The ore is characteristic of the district generally. The lessees are erecting a mill, the equipment being a crusher, rolls, screens, and cyaniding facilities. The others concerned in the leasing company are J. R. Bryan, T. A. Fleming, and F. H. Stickney.

SALT LAKE, UTAH.

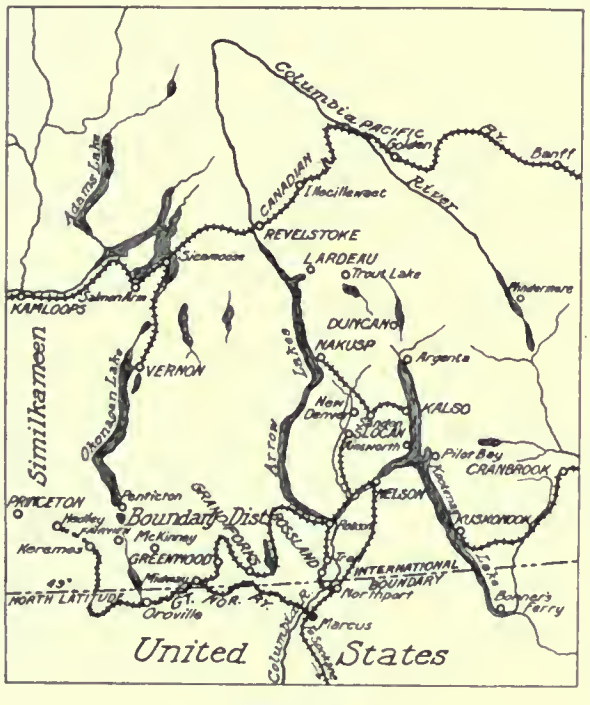
Annual Report of the Daly-West Mining Co.—The Yampa Smelter.—Phoenix Co.—Bingham-New haven Co.—Utah-Apex Property.

The annual election of shareholders of the Daly West Mining Co., held at Denver, resulted in the re-election of the retiring board of directors. During the year 1907 the company treated or shipped 24,856 dry tons of ore. From 8521 tons of crude ore was produced 243,061 lb. copper, 2,289,598 lb. lead, 360 oz. gold, 367,531 oz. silver, which sold for $242,959. From 7480 dry tons of concentrate was produced 229,250 lb. copper, 4,211,972 lb. lead, 305 oz. gold, and 407,968 oz. silver, the same selling for $162,315. The recapitulation shows that the mine produced 673,890 lb. copper, 8,036,456 lb. lead, 949 oz. gold, 1,042,062 oz. silver, the total net value of which was $771,679. The average assay of the crude ore was: Silver, 43.13 oz. per ton; gold, 0.0423 oz.; lead, 13.43%; copper, 1.4%; the net selling value being $28.51. In the concentrate there was: Silver, 54.54 oz.; gold, 0.0408 oz.; lead, 18.14%; copper, 1.53%; net selling value per ton, $48.45. Miscellaneous ore: Silver, 30.10 oz.; gold, 0.0321 oz.; lead, 9%; copper, 1.14%; net selling value per ton, $18.33. The receipts for the year from all sources, including $451,319 on hand at the beginning, amounted to $1,228,764; while the disbursements aggregated $923,696, leaving a balance on hand December 31 of $305,057; while the reserve fund contained $8,982 additional. Dividends were paid to the amount of $378,000, making a total since incorporation of $5,877,000. The total earnings during the life of the company has been $11,975,117.

The Yampa smelter, situated in Bingham canyon and operated by the Tintic Mining & Development Co., is operating two reverberatory furnaces and one blast furnace; and a second blast furnace will be blown in within a few days. A third reverberatory is being put in and plans have been made for installing a third blast furnace, which is to be 44 by 300 in. at the tuyeres. It is also given out that a copper converter plant of two stands has been ordered and is to be ready for work in about 90 days. With the present equipment of two blast furnaces and two reverberatories about 650 tons of ore per day can be handled. The ore, which is a chalcopyrite, carrying some gold and silver, is conveyed from the Yampa mine to the smelter over an aerial tramway. The fine ore, which is separated from the coarse by revolving screens, is run through McDougal roasters, of which there are six, with three others to be installed. By this roasting the 30% sulphur is reduced to 5%. Accessory to the system of roasters is a dust chamber 60 ft. long, 30 ft. high, and 18 ft.

wide, connected to a brick stack 120 ft. high. The first reverberatory furnace is 17 by 55 ft. and the second is 17 by 45 ft., there being a separate brick stack for each one. The charge for the reverberatories is made up of the roasted ore and the flue-dust, to which is added some silicious gold ore, the product being 30% copper matte, containing the gold and silver. The slag from the reverberatories runs 38% silica, 42 to 44% iron. The material collected in the dust chamber is worth $70 per day. In the reverberatories it is stated that one ton of coke will produce the necessary heat to smelt four tons of the calcined ore, while in the blast furnaces from 9 to 10% coke is required in the charge. C. W. Saxman is manager of this company, with J. C. Dick as general superintendent, and Frank J. Murphy, superintendent of the smelter.

The Phoenix Mining Co. has just completed a 200-ton concentrating mill on Carr fork, equipped with crusher, rolls, jigs, and tables, to be operated by electric power. This company's property is in the vicinity of the Apex and Yampa mines, and is con-



British Columbia.

siderably developed by adit-levels, opening a lead vein that is 7 to 14 ft. wide. The upper workings disclose carbonate ore and in the lower levels is a fairly clear sulphide. The shipping ore is said to run 35 to 45% lead and 10 oz. silver per ton, while the milling ore will make a 40% lead concentrate when reduced in the ratio of 5 tons into 1 ton. A 2700-ft. cross-cut has been driven to the vein on the mill-level; and there are three adits which follow the vein at higher points, these being 2400, 1800, and 600 ft. long, respectively. H. A. Gephardt is superintendent.

The Bingham-Newhaven Co., managed by C. H. Doolittle, occupies a position on the upper part of Carr fork, above the Highland Boy mine. Work has been in progress here for several years, during which time a dozen adits and cross-cuts have been driven, all but three of which have cut ore. There is a vertical distance of 1200 ft. between the highest and lowest workings. The lowest adit is 200 ft. long and is expected to intersect the vein on its dip, which is to the northwest. The ore uncovered is in the limestone against the quartzite, and carries copper, iron, silver, and gold. A shaft is being sunk at a point in the lowest adit 900 ft. from the portal, where a hoist is stationed, operated by compressed air. The company has a first-class air-compressor plant, electrically operated, and a tramway line from the mine to a connection with the Copper Belt railroad. H. J. Turley is superintendent.

The Utah-Apex Mining Co., managed by R. S. Oliver, is developing its property, which lies adjacent to the Yampa and Utah Consolidated. This is a Boston company whose holdings here comprise an area of 200 acres. Development is sufficient to show valuable bodies of both copper and silver-lead ore. Like other mines on Carr fork, this property is being opened by a series of adits entering the mountainside. A large tonnage of ore is said to have been blocked out.

ROSSLAND, BRITISH COLUMBIA.

Ore Shipments.—Trail and Northport Smelters.—A Tunnel Scheme.—Hall Mine and Smelter.—St. Eugene.

The Consolidated, Le Roi, Le Roi No. 2, and Evening Star mines are maintaining regular shipments, the combined tonnage averaging 5600 tons of ore per week. W. A. Carlyle, consulting engineer for the Le Roi Mining Co., is here from London, and is making a thorough examination of the mine. At the Northport smelter only one furnace (out of six) is in operation; this is treating 200 tons of ore per day. Besides the Le Roi ore, the smelter is treating about 500 tons of custom ore per week. The Consolidated plant at Trail is smelting 5500 tons per week. The receipts of lead ore for January were 3,682,594 lb., more than half of which came from the St. Eugene mine. The next largest shipper is the Vancouver mine in Slocan.

The Granby Co. continues to mine and smelt the regular quantity of ore. Total shipments for January were 74,203 tons, which, at 24 lb. copper per ton, means a production of 1,725,000 lb. of metal. Early in this month a shipment of 400 tons of ore was made from the Snowshoe mine to Trail. This was shipped to fill a special requirement at the smelter. No move has been made to resume work at the Snowshoe or B. C. Copper Co. mines.

Newspapers here are giving considerable space to a proposed tunnel scheme. The idea is to run a tunnel from Greenwood to Phoenix cutting the orebodies of the latter camp at a depth of 2100 ft. The cost is to be $3,000,000 and the Greenwood city council is to give a bonus of $50,000. While the tunnel would no doubt prospect a number of claims along its line, the writer is skeptical as to whether it would pay unless an arrangement is made whereby they would benefit by ore encountered, or unless they became entitled to tunnel-claim rights, as it would not pay to ship Phoenix ore through such a tunnel, under present conditions.

The Hall smelter and the Silver King mine, near Nelson, have passed into the hands of the debenture holders. It is stated that work will be continued actively. This mine was a prime factor in the upbuilding of Nelson and paid well until the ore was lost. Recent work re-opened the orebody, but the company did not have funds to continue development. The smelter, which was built to treat Silver King ore, is out-of-date and was not a success as a custom plant. It will be re-modeled.——The St. Eugene is shipping 325 tons of silver-lead ore to Trail in addition to the quantity concentrated. They are now extracting ore from a body 40 ft. wide and 300 ft. long on the 2000-ft. level. S. G. Blaylock has succeeded the former superintendent, W. P. White. ——At a recent meeting of the Sullivan Co., James Finley was appointed manager and the head office was removed from Spokane to Marysville, where the smelter it situated; this will be more convenient.

Concentrates.

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

The cost of producing one ton of white tin from a cassiterite concentrate containing 70% of the metal is $10 or less.

Fine grinding is essential to high extraction in the cyanide process, but there is an economic point beyond which the grinding must not be carried.

All gelatin dynamites are more difficult to explode than are the ordinary brands, and require quintuple force caps or double strength fuses to develop the full force.

Tool-sharpeners will find it well to keep their slack tub clean. The accumulation of sediment in the tub will cause checking of the drill-steel. Never let anyone pan in the water of your slack tub.

Powder in which nitrate of ammonia has been substituted for a part of the nitroglycerin has a decided advantage in seamy rocks and material which breaks easily, where much of the force of ordinary dynamite would be lost.

Sale of explosives in bad condition is actionable if damage accrues and the merchant knew he was selling powder likely to cause injury and injury actually resulted; otherwise the right of action is limited to recovery for the money paid for the worthless powder.

When blasts fail to explode, do not attempt to drill or bore down to the charge, but clean out the hole to within about 8 in. of it, put in a fresh cartridge or a piece of one, fill up the hole again and fire. This will explode the charge below unless the dynamite is frozen.

Road-work may, under certain conditions, be credited to assessment work on a mining claim. If the road is necessary in order to reach the particular mine, such work may count for assessment; but if it is intended to serve the district generally, then the cost of it cannot be so applied.

In constructing the Simplon tunnel, which extends from Brigue, Switzerland, to Iselle, Italy, a speed of 20 to 22 ft. per 24 hr. was maintained for long periods in a heading 10 ft. by 6 ft.; as a maximum, for a period of a whole month about 765 ft. were extracted. The progress made was remarkable.

The potassium cyanide contained in the discharged residue from a cyanide plant sometimes causes the death of cattle. The trouble may be partly eliminated by fencing the land where the sand settles, but the slime, flowing a long distance, may carry a fatal dose for any animal that drinks in the stream. This may be prevented by placing copperas in the launders carrying the slime to the creek.

The price of antimony ore in California appears very low relative to the market price of the metal. When commercially pure antimony is quoted at 12c. per lb. or $240 per ton of 2000 lb., the ore could be sold in San Francisco for only 60c. per unit; thus, $30 per ton would be paid for ore containing 50% antimony. While the cost of treatment is expensive and the loss during reduction heavy, the chief reason for the low price of ore probably is the fact that the supply is too limited to warrant the erection and continuous operation in California of a properly equipped antimony reduction plant.

Boulders and large blocks of stone are best broken by drilling a one-inch hole into the stone to a depth of 6 to 10 in. A half stick of 60 per cent dynamite exploded in such a drill-hole will break a large boulder. When it is not convenient to drill the rock or there is not time, lay the dynamite on top of the stone and cover it with a shovelful or two of mud or moist earth. As dynamite acts almost exactly like a blow from a hammer, the charge should be placed on the boulder on the spot one would strike if attempting to break the rock with a hammer. Advantage should be taken of any seam or depression there may be in the rock.

On the Rand the tendency for years has been to increase the weight of stamps. The majority of stamps dropping on the Witwatersrand at the present day weigh 1250 lb. each. For several years this was looked upon as a standard weight, but now new mills or additions to existing mills are being erected with heavier stamps. The 300 stamps of the joint Simmer Deep-Jupiter mill will weigh 1700 lb. each. The 20 new stamps for the New Kleinfontein are to weigh 1635 lb., those of the Cinderella Deep 1680 lb., and those of the Wit Deep, 1400 lb. each. At the Luipaardsvlei Estate, Jack East, and joint Knights Deep-Simmer mills stamps weighing 1550 lb. have been in use for a considerable time.

Consumption of Horsepower.—In the Bunker Hill & Sullivan mill at Kellogg, Idaho, there is in use a General Electric Co.'s type L 85-hp. induction motor marked 22.5 amperes, 2080 volts. It has a constant load of 28 vanners, 14 Wilfley tables, three 2-in. centrifugal pumps, and two 6-ft. Huntington mills. Huntington Mill No. 1 crushes a 36-mm. galena concentrate (containing 50% lead) through a 16-mesh diagonal slotted screen, treating 35 tons in 24 hr., with two mullers. This mill uses 9 hp. Huntington Mill No. 2 crushes a 10-mm. middling (siderite) through 12-mesh diagonal slotted screen, treating 100 to 112 tons in 24 hr., with four mullers. This mill uses 16.3 hp. The full load is 64.2 horsepower.

A simple method for the detection of an objectionable quantity of carbon dioxide in the air of mines that has been used by the Inspectors of Mines in the Witwatersrand district of South Africa is the use of a solution of sodium carbonate colored with phenolphthalein. This solution is made on the morning of the day of use by diluting a stock solution consisting of 1 gm. of phenolphthalein and 5.3 gm. of sodium carbonate per litre of water, fifty times with water free from carbon dioxide. The Inspector of Mines is provided with six small bottles (with rubber corks) each containing 10 c.c. of the dilute reagent, and with six bottles of 195 c.c. capacity. By means of a 2-ft. rubber tube the original air is sucked out of one of the large bottles and then the contents of one of the small bottles is emptied into it; the glass stopper is replaced in the sample bottle and it is shaken for two minutes. If the pink color disappear, the air sampled contains more than 1.5 parts per 1000 of carbon dioxide and is, therefore, bad. If there is not sufficient gas present in the air to make the pink color entirely disappear, the proportion may be roughly determined by estimating what fraction of the color has disappeared.

Discussion.

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy.

On Technical Writing.

The Editor:

Sir—The occasional letters and editorials under the caption of 'Technical Writing' are of extreme interest, as they deal with a subject which lies at the very root of technology. While no one can question that there are many men who can do things without being able to write a clear account of how they do it or why, yet no man who has studied the science of his calling and is supposed to be a professional man can be said to have completed his training unless he can clearly explain in writing the how or why of the various phases of his work. The man who cannot give a lucid concise statement on the ordinary topics of his branch of technology can hardly think clearly in an orderly manner, however good a mechanic he may be. When one learns, therefore, that a vast number of technical graduates cannot write an ordinary essay without numerous gross errors, and that there are numbers of engineers that cannot write a lucid report, there is grave reason to question the character of the training that the colleges, responsible for such graduates or engineers, may give.

This much seems apparent. But I do not believe it is the whole truth. There are many men who can dictate a fine piece of letter-writing whose brains appear paralyzed when they get a pen in their hand, and there are others whose thought only seems to flow when they take up a pen or pencil, and who could not dictate a dozen concise grammatical sentences. There are then other elements entering into the question of the expression of one's thoughts than the mere possession of knowledge. Nervousness, lack of appreciation of one's ability to make a clear statement, stage-fright, and modesty all are elements to be considered. Nor is this merely true of writing. It applies with more force to the oral exposition, which may, at times, be as important as the written statement.

An engineer in his time plays many parts. An important part, and one generally overlooked in discussions of this subject, is that as soon as he reaches a position responsible for the success of an engineering work he has first to win the support of others to get means to carry on the work; second, to prevent the opposition party, which nearly always exists, gaining head and stopping work, and third, to gain and hold the loyalty of those associated with him in the practical carrying out of the plans. In doing these things he may have to address meetings in which his every word and action will be noted critically, or write reports and special statements.

The art of expression is therefore of prime importance, and is as essential a part of an engineer's equipment as a working knowledge of trigonometry. For a subject of such wide interest and of such essential a character, it has received but very little attention and even such discussion as you were good enough to initiate in the MINING AND SCIENTIFIC PRESS is meagre and lacks real practical value. It is not enough to point out that we write poor English. That we are all painfully aware of. Who is there who can read a paper of his own after it is put into cold print, when all the errors are past recall, without shuddering at the baldness of his English or without realizing how far short of what he intended the article really is? The crudities stick out all over the pages like sore thumbs. Help in this important branch of engineering training is greatly needed and the PRESS has done a good service in bringing it to the real attention of the profession. Of all the weary stretch of books written to elucidate the art of writing the English language, not one, as far as I know, has ever been written for the need of technologists.

It is a fact worthy of remark that nearly every engineer of reputation writes clearly and forcibly, and not infrequently with a touch of humor and imagiuation that sparkles and illuminates the thought as nothing else could. Whether by instinct or art, the finished engineer usually writes in a style exactly adapted to the occasion. In writing to a stupid board of directors he will use the language and often the forms of diplomacy; to a refractory or willful assistant he will be tactfully forceful; writing for students, a bright style with some touches of fancy all making a helpfully suggestive essay; a paper read to his critical peers giving the result of personal research will be a cold, logical statement of fact redolent of the study, workshop, or laboratory. The popular statement, the essay or article, the pamphlet and book all have their own definite rules of literary expression, and it is to the credit of the engineering profession that its leaders are almost invariably masters of each style.

This is not due to a mere chance, or merely an outcome of the nature of engineering work, although dealing, as the engineer must, with nature in all its manifestations in all parts of the world, he has so many interests that he is usually an omnivorous reader of good books. But frequently he owes his literary ability to painfully slow methods of self study to supplement his early schooling and to supply that which his college, if he ever went to one, miserably failed to give. One will find in nearly every such engineer's library a row of books like 'Slips of Tongue and Pen,' 'Plain English,' 'The Queen's English,' 'The Dean's English,' 'Roget's Thesarus,' Brewer's 'Dictionary of Phrase and Fable,' and so forth. He has imbibed a good deal of this and applied the rules to the peculiar necessities of the engineering literary style. Imagination, without which no man can be great in any phase of life, together with a culture coming from the constant association with able men, and above all with nature, does the rest.

It is readily demonstrable that the mere knowledge of the meaning of words and the rules of syntax are not sufficient for the technical writer. These are too often, like the knowledge of the grammatical rules of a foreign language, never ready when wanted. Practically there can be no question but that the power of writing must be acquired by hard practice, just as we learn to ride or swim. As nearly every man can learn to stick on a horse or keep from drowning for a reasonable time, so all can learn to express their thoughts by pen and tongue, although of course, with different degrees of skill. There is hope for all. It is mainly a matter of practice. Innumerable instances might be given of the development of the art of skillful writing even in unpromising cases; that of Dean Swift—who could not pass his university examinations—to sway an empire by the sole use of his pen in his maturer years, is famous.

The advantage of an able use of the English language being manifest and the possibility of any man of average ability to acquire at least a good working use of it being unquestionable, it is surely pertinent to ask why so many graduates of our technical colleges so generally lack the power of using simple direct English. Undoubtedly one of the main causes is the poor, not to say slipshod and even slangy English used by many professors in their lectures. The evil is accentuated by allowing the students to keep disgracefully poor notes. Of course many lecturers carefully prepare their discourses and critically study the students' notes, but as a rule, the English of the lec-

turer receives very little attention. Poor lecturing and bad note-taking form a very bad foundation for an accurate use of the English language.

Another point in technical training which has received but little attention is the necessity, as it seems to me, of a training in logic. It is greatly to be regretted that no treatise on logic has ever been written suitable to the needs of the engineer. The pious idea that mathematics give all the training needed in this subject by an engineer is utterly fallacious. In the first place mathematics is so poorly taught, as a rule, that even from the mathematical point of view the training is poor; much worse is it, therefore, from the logician's standpoint. Oliver Lodge puts the case excellently well, thus: "The mathematical ignorance of the average educated person has always been complete and shameless, and recently I have become so impressed with the unedifying character of much of the mathematical treatment to which ordinary children are liable to be exposed that I have ceased to wonder at the widespread ignorance." Most engineers, if they are candid, must admit with Trautwine that they "have long since forgotten the little higher mathematics they ever knew," and that "few engineers are good mathematicians." So that, on the evidence of two very distinguished authorities, as a poor substitute for logic we have mathematics, which subject is taught badly and forgotten promptly.

Really good lecturing, careful note-taking, and the introduction of logic as an essential part of a technical training would greatly aid the student in acquiring an accurate use of English. If he cannot have logic, there is no reason why every student cannot have the other two advantages. In this connection the increasing practice of giving students neatly prepared lecture notes ought to be condemned. No student knowing that he will receive a nicely typewritten or printed set of notes is going to keep his own personal lecture notes as carefully as he otherwise would. He thus loses a great educative exercise and loses at the most critical stage of his career a great opportunity of practicing the art of writing, which he so much needs.

As a method of mental training, the writing out of one's experiences and observations is unexcelled. Especially when accuracy of description is the main motive of the student. Accuracy of expression necessarily involves accuracy of knowledge of the meaning of words, and thus by constant practice and effort the student will approach the most perfect of scientific literary styles, namely, that in which the writer cannot be misunderstood. By a little care he will be able to attain accuracy without wrapping his thoughts in ponderous sentences, of which the euphony is entirely destroyed by modifying or restricting sub-sentences. Such a style as that, for example, of Pattison-Muir is to be avoided. On the other hand, a deliberate attempt to copy another's style, or—worse still—to develop a style of one's own, is bound to result in absurdity. Above all, a man should write naturally and as he feels. While, of course, he obeys the fundamental rules of grammar, he will find that he can break with impunity many of the rules of stylists or absurd purists; even to the use of the split infinitive on occasion.

Yet more important than being able to write so as not to be misunderstood is the fact that such a style will also result in the writer clarifying his own thoughts and not misunderstanding the workings of his own brain. Often we approach a subject with confidence that we understand it until we commence to write on it. If a man is honest with his own brain he will many times find that he has only half thought out a subject and that awful gaps exist in his knowledge. Such revelations are of immense help to the engineer who can then quietly strengthen his weak spots before a disastrous professional experience rudely displays them to him.

As stated previously, every form of literary expression is governed by its own rules. Technical writing is no exception. The arrangement of an article for the weekly journal is more or less that of an essay and should be carefully modeled so as to sustain interest. It is frequently polemical and should always be suggestive. To be well constructed such an article must follow a modified classical model. On the other hand, an article may be strictly a record of a technical experiment and should be a cold, logical, impartial statement of fact. The thesis and the scientific or technical book are governed by other laws, and these are modifiable by the nature of the subject or the motive for writing it. Thus we see that no one set of rules can be laid down. This statement is further complicated by the fact that each writer can modify the strict models by his own sense of propriety or taste. Forms and models of mine reports have often been published, and many are truly excellent. To follow these rigorously will result often in a wooden effect and even, in many cases, defeat the object of the report. The fact is, the style of a report is governed largely by the nature of the subject reported upon, and the object of the report. Not infrequently, the character and intelligence of the man for whom the report is made have much to do with the style adopted. A report for a veteran mining man may be written very differently to that for a Chicago business man who seriously believes that a stope-wrench is an essential tool of mining.

It would seem from the foregoing statements that the art of technical writing is a very complicated one. Of course it is not, and it appears so only from the brief presentation given above. It can readily be acquired if the student will commence to study the form of the technical literature he reads as well as the matter. He will thus soon learn to distinguish the better forms from the worse and unconsciously adopt the better forms modified by his own peculiar temperament. As a piece of practical advice, let the student carefully read one journal, instead of hastily skimming many. Let him study the style of the editorials, the staff writings, general contributed articles, and down even to the commercial paragraphs. He will get more technical information and a clearer idea of literary propriety in this way than by the careless reading or rather attempted reading of many journals.

Of course, the hackneyed advice to read good English is sound. Yet I would add, in such reading have the dictionary ever ready to the hand. The many absurdities one often reads would never have been perpetrated if their authors only knew the real meanings of the words they used. Much advice has been given as to the authors to read. My own selection would be Milton's prose writings, as models of form and power of expression; Swift, for clear, logical, and convincing writing; Addison and Goldsmith for elegance and smooth easy diction; and Elia's 'Essays' as models for sustaining interest to the very end, even in trifles. Of all these, Swift is perhaps the best author to read for the technical man; his wonderfully plain, easy, simple style, so logical and exact, is a good model. Anyone who could read an unexpurgated and well annotated edition of 'Gulliver's Travels' without interest is poor timber for the mining engineering profession. The reading of such works as those mentioned above should not be approached as a task but as a diversion from the steady grind at text-books, and as a means of acquiring that easy manner of expression which is the hall-mark of the cultured man of the world. Of course, such a course of reading should not neglect the great moderns, among whom the scien-

tific men, like Huxley, Kelvin, Oliver Lodge, Proctor, and Tyndall, all shine as masters of English. Let Faraday's 'Chemical Manipulation' be read by the chemical and metallurgical student as a model of exposition. For the most simple chemical phenomenon is explained in such lucid English that no student can fail to learn and appreciate the art of full and complete statement.

Practice, and plenty of it, is essential to the acquisition of the art of writing. This the student can always have. He can learn the art of accurate statement by carefully writing up his own laboratory experiments; conciseness, by taking good lecture notes; restraint, by writing for the college publication, where bumptiousness is a cardinal sin; and an easy, natural style by writing full, frequent, and candid letters to his home folk. Conciseness of statement should be steadily aimed at by the student. He will do well always to keep to matters with which he is perfectly familiar. The practice of covering a lack of precise knowledge by writing in glittering generalities is as much a failure in the work-a-day world as it is in the examination room. The advice of the great Duke of Wellington to a young public speaker who wanted to know how to talk so as to have real influence, is as useful to writers as to orators. This was: "Get up. Say what you have to say. Don't quote Latin, and sit down." Which is very good advice to anyone.

A. W. WARWICK.

Choix, Sinaloa, Mexico, September 25.

The El Oro Tube-Mill Lining.

The Editor:

Sir—The large number of claimants of the El Oro tube-mill lining who have recently appeared presents an amusing as well as gratifying commentary on the value of the device. The latest contribution, that of Mr. Arthur De Wint Foote, published in your issue of February 1, and the editorial comment upon it, are the most entertaining dissertations on the subject that have yet appeared. Neither, however, are important, in that they do not seriously touch on the essence of the case.

The points of priority of invention, patenting, and practical application still remain with the writer, since the dates given by the various claimants are antedated even by the date of filing of my application for a U. S. patent, which application was made nearly a year after I had originated the device. In the meantime it was being used and perfected by the El Oro Mining & Railway Co. Dates are not matters of opinion, but of fact readily compared and verified. I conceived the idea of the liner in 1905, and filed application for a U. S. patent on June 13, 1906, which patent, No. 864,357, was issued to me on August 27, 1907. The other much discussed claims have all materialized since the lining was first used at El Oro.

Mr. Foote speaks entertainingly of an old boiler-tube mill which he started to make "about three years ago," which was never used. "During the winter of 1906" he made another lining, but does not narrate the results of operation or whether it was used at all. Mr. Barry of New Zealand invented a lining in which pieces of flinty quartz were "held in cement." Mr. Foote thereupon says of the cast-iron lining used for tube-mills at El Oro: "In many ways it is similar to Barry's." This remark might be equally true of almost all forms of tube-mill lining, which are neeessarily similar in many ways. Mr. Barry's lining, however, omits the essential feature of holding the pebbles frictionally in place. In his lining the flint is cemented in place. In the El Oro lining the pebbles are hammered by each other into the channels, thus automatically forming a flint lining. To accomplish this the channels are wider at the opening than at the bottom. As a pebble becomes fractured or worn and escapes from the channel the vacancy is automatically re-filled by a suitable pebble from the charge. There was no record or patent in existence of this essential feature before I conceived it. Cementing the silex in place is a widely different and vastly inferior method of procedure.

Recently a well known manufacturing company has issued a letter offering for sale a lining "which will accomplish the same end"; this may also be "in many ways similar to Barry's" and yet not possess that feature essential for success which I claim to have discovered, namely, the automatic wedging or holding by frictional contact of a portion of the pebbles of a charge in place to form the grinding surface of the mill, and in this way protecting the iron from wear.

Mr. Hardinge admits that his Mexican patent was issued to him under date of February 22, 1907, so we need not further pursue the inventor of the conical tube-mill.

Mr. C. E. Rhodes' letter in the MINING AND SCIENTIFIC PRESS of December 21, 1907, also states, in addition to what Mr. Foote quotes, that "the rib liner mentioned was invented by J. R. Brown while in the employ of the El Oro Mining & Railway Co." In his letter in *The Engineering and Mining Journal* of December 14, 1907, Mr. Rhodes further states that the lining was used "at the plant of the El Oro Mining & Railway Co. considerably more than two years ago." These statements indicate that the lining was invented by me in 1905, which is confirmed by the date of the filing of my application. During the time the lining was being perfected Mr. Rhodes was cyanide superintendent of the Dos Estrellas Company.

O. Crimmann and R. Riley obtained a Mexican patent dated August 29, 1907, for a lining in which the channels are smaller at the opening than at the bottom. Such an arrangement allows the pebbles to enter the channels where, if held at all, they remain loosely without presenting a fixed grinding surface. It is significant to note that Mr. Riley was foundry foreman at the El Oro Mining & Railway Co. at the time the El Oro lining was developed. His form of lining is copied from one of the earliest linings, which I discarded, finding after experiments that the principle was wrong.

Mr. Foote's admonition to "Render unto Caesar the things which be Caesar's" applies, in my modest opinion, to the equally well known name of the writer. If the lining really was used in Caesar's time, as Mr. Foote intimates, I give up; but if at any time later I claim it. Some time ago I arrived at the decision advocated by you, sir, to "perfect and manufacture the device and show others how to use

it successfully." This I have done by associating with the Blaisdell Company, with whom I am working, with some degree of success, to market and exploit the lining.

It is my desire in this letter to thank my friends who have loyally supported me in this discussion; to assure the mine managers, and others, of my desire to sell to them at a small profit an untainted lining which they may safely buy and use; and to try if possible to lay to rest forevermore the weary wandering ghost of a doubt as to just who is the inventor of the El Oro tube-mill lining.

JOSEPH RODNEY BROWN.

Los Angeles, February 10.

Resue or Dissue.

The Editor:

Sir—In 'Concentrates' of December 21, the term 'resuing' is defined, with the remark that "*resue* is sometimes improperly called *desue*." Surely this statement should be revised if not reversed, for *resue* (whatever its derivation may be) seems to be of very recent, if not spurious, coinage; on the other hand, *dizzue* or *dissue* or *dyzhu* has been used by some of the oldest English writers on mining, and is still current with exactly the same signifieanee which 'Coneentrates' attributes to *resue*. Both the Standard and Century dictionaries inelude *dissue* or *dizzue*, but not *resue*.

S.

Lead, S. D., January 20.

[Our contributor is right. *Dissue* is the older form and we shall be glad to see it in service again; it is good Cornish.—EDITOR.]

Green Gold.

The Editor:

Sir—Referring to the discussion concerning an alloy of gold and silver that has a greenish east or color, I believe that such an alloy has been known to jewelers for many years. I would refer you to Brannt's 'Metallic Alloys,' page 404, paragraph on gold and silver alloys, from whieh I quote as follows: "These alloys are known to jewelers under the names of yellow gold, green gold, and pale gold, according to the proportion of silver."

LOCHIEL M. KING.

San Francisco, February 8.

Pure Cyanide in Silver Plating.—Certain silver platers use only purest potassium cyanide, claiming that an admixture of sodium cyanide is injurious for plating purposes. Commercial cyanide gives an uneven deposit, eauses loeal aetion, and silver is only thoroughly deposited in the immediate vicinity of the anode. A similar faet is true in gold plating, the sodium cyanide causing a difficultly soluble sodium aurous cyanide to deposit on the anode. The average commercial potassium cyanide contains about 20% sodium cyanide; some is almost entirely the sodium salt, while one specimen contained two-thirds sodium chloride.—Metal Industry, Jan., 1903. Abst. in Jour. Amer. Chem. Soc., May, 1903, p. 221.

Decisions Relating to Mining.

Specially reported for the MINING AND SCIENTIFIC PRESS.

In order that a 'grubstake' contract, by which one person agrees to furnish supplies for a prospector and share in any mining claims he may locate, shall constitute a partnership relation, it is necessary that the agreement extend beyond the mere furnishing of supplies and should be in consideration of a participation in any discovery made.

Costello *v.* Scott, (Nev.) 93 Pac. 1, Jan., '08.

A member of a prospecting partnership located certain mining claims and, together with others interested, conveyed a townsite surface right to a third person, in consideration that he perform the location work necessary to hold the claim, and to survey and plat the same. It was held immaterial, as against the partnership, whether such third person did the work himself, or subsequently made arrangements that the work should be done by another.

Costello *v.* Scott, (Nev.) 93 Pac. 1, Jan., '08.

Where a partnership for the location of mining claims was practically without funds necessary to carry on the enterprise, a member of the firm was held to have authority, in good faith, to convey certain townsite surface rights embracing such claim, in consideration that the grantee would perform the location work necessary to hold the claim.

Costello *v.* Scott, (Nev.) 93 Pac. 1, Jan., '08.

Under a constitutional provision requiring the legislature to provide for an eight-hour day for persons employed in mining, or other branch of industry that it may consider injurious to health, it was held that under the police power the legislature alone must regulate the hours of labor, and could not delegate it to either of the co-ordinate departments of the Government.

Burcher *v.* People, (Colo.) 93 Pac. 14, Dec., '07.

Two persons were equal owners of mining claims by virtue and right of discovery and location. One of the owners conveyed a one-fourth interest and the other a three-fourths interest of such claims to a mining corporation; thereafter, under judgment and decree, the mining company re-conveyed to such original owners by separate deeds the same share or interest in the mining claims, that each had theretofore conveyed to it. It was held that the conveyance by such joint owners and the re-conveyance to them did not affect or destroy the original equal ownership in the mining claims.

Ames *v.* Howes, (Idaho) 93 Pac. 35, Dec., '07.

Where coal rights in land assessed in the last quadrennial assessment were sold, it was held that such coal rights could be assessed to the purchaser before the next quadrennial year.

People *v.* O'Gara Coal Co., (Ill.) 83 Northeast 140, Dec., '07.

An employee in a coal mine was directed to mine the coal in a particular manner; the employee, from his experience, knew that the manner of mining the coal as ordered was more dangerous than another method, but proceeded to do so, not relying on the superior judgment of his employer. It was held that he could not recover for an injury on the ground that the employer failed to furnish a reasonably safe place in which to work, but otherwise not being negligent. If, with knowledge of the danger, he proceeded with the work as directed, he assumed the risk ordinarily incident thereto.

Kirby *v.* Hillside Coal Co., (Ky.) 106 Southwest 278. Dec., '07.

ZINC AND LEAD DEPOSITS OF SOUTHWESTERN MISSOURI.

Written for the MINING AND SCIENTIFIC PRESS
By F. LYNWOOD GARRISON.

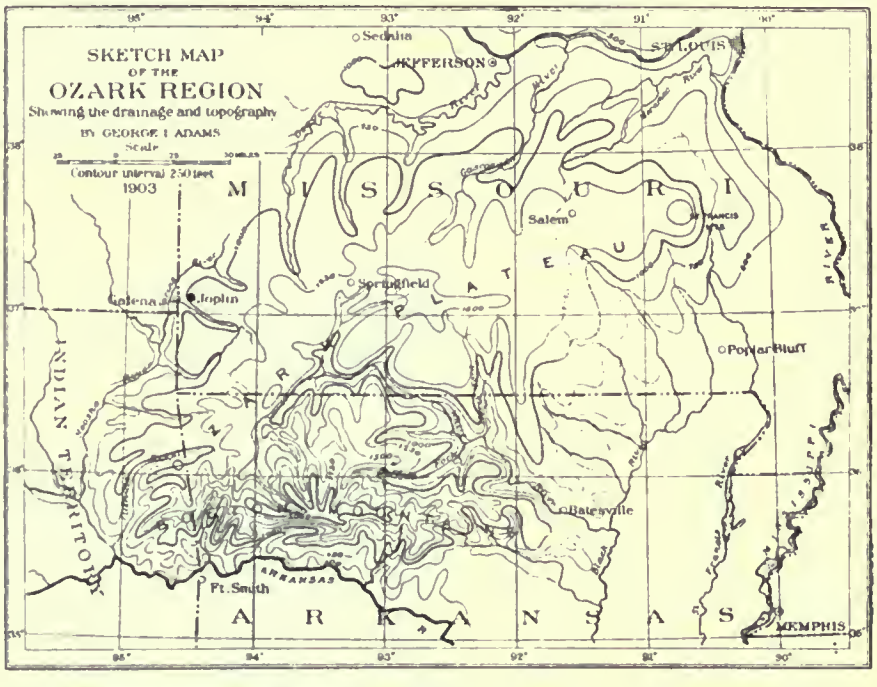
The zinc and lead mining region that traverses Missouri, Kansas, and Indian Territory is practically contained within the limits of Jasper, Newton, and Lawrence counties, Missouri, the extreme southeastern corner of Cherokee county, Kansas, and the Quapaw Nation, in Oklahoma. In this should be included Baxter Springs, just a little south of the Kansas line, but in the Indian Territory. Although zinc and lead are separately and collectively mined in other parts of Missouri, the tract under consideration is confined to this specific area; it is now and will doubtless continue for many years to be the greatest zinc producing region of the world. The so-called Joplin 'district' is practically confined to Jasper county, a small part of the northern half of Newton county, Missouri, together with Galena in Cherokee county, Kansas; the latter being a relatively limited area. The principal mining towns in this region are Joplin, Webb City, Carterville, Oronogo, Galena, and Baxter Springs. The only mining towns of any considerable importance outside of these limits are Aurora and Stott City in Lawrence county and Granby in Newton county, Mo. The last is one of the oldest, if not the oldest, in the region, and was famous years ago as a lead producer, the zinc ore in early days being considered so worthless as to be thrown on the dump. Many smaller settlements exist throughout the region, which covers an area of over 3000 square miles and has not yet been fully developed. In fact, it is possible, though not probable, that zinc ore may eventually be found upon every square mile of this large territory. Some localities will of course be richer than others, and doubtless a majority of the deposits ultimately developed will not pay to work.

The general geology of the region has been described in the publications of the U. S. Geological Survey, the Geological Surveys of Missouri, Iowa, and Wisconsin, besides a number of independent papers.

This Missouri-Kansas zinc field is contained in a relatively elevated area known to geologists as the Ozark uplift, described by Jenney as nearly quadrilateral in shape, covering the southern half of Missouri and nearly all that portion of Arkansas lying north of the Arkansas and directly west of the Black river, extending for a short distance over the contiguous corners of Indian Territory and Kansas, an area aggregating over 50,000 square miles.[1] The elevation of this area varies from 400 to 2000 ft. above the sea; the central plateau, comprising the greater part of the uplift, having a height of from 300 to 1500 ft. The metal-producing districts are divided roughly in two: the southeast field, comprising the counties of Jefferson, Washington, St. Francis, Ste. Genevieve, and Madison, in Missouri; and the southwestern district, covering the country drained by the tributaries of the Missouri and Mississippi rivers where the States of Missouri, Kansas, and Arkansas, and the Indian Territory corner nearly together.

The country rock of Joplin is a limestone belonging to the Keokuk and Burlington sub-stages of the Lower Carboniferous, or as it has been more recently designated, the Mississippian.[2] This rock was at one time covered by the formation commonly known as the coal measures (Cherokee shales of the Pennsylvanian), consisting of conglomerate, sandstone, and shale interstratified with coal seams. Within the area under consideration these beds have been almost entirely removed by erosion and disruption, leaving here and there small pockets or patches of shale, sandstone, and occasionally a little coal. According to Winslow, these pockets occupy what were originally depressions of circular outline, which are probably sink-holes in the underlying limestone[3]. The beds of the coal measures are sometimes horizontal, undisturbed, and occasionally found capping mounds or hill-tops, but often tilted or broken.

The zinc orebodies found in the limestone occur in, and are intimately associated with, massive tabular and lenticular masses of chert (flint) apparently filling pre-existing cavities, cracks, seams, and fissures in the limestone. This chert may or may not be ore-bearing, but it is invariably associated with the ore and constitutes the bulk of the gangue, though occasionally limestone, sandstone, and even



Map Showing Position of the Joplin District. After U. S. Geological Survey.

[1] *Trans.* A. I. M. E., Vol. XXII, p. 173.

[2] *Bul.* U. S. G. S., No. 80, 1891, p. 123.

[3] *Trans.* A. I. M. E., Vol. XXIV, p. 641.

the black shales, are found with the ore. The chert masses carrying the ore are often of great size—hundreds, even thousands, of feet in length and breadth. The length is much greater than the width since they are usually elongated, though irregular, bodies, known locally as 'runs.' The rough ore is essentially a mass of brecciated chert, the interstices of which are filled with a dark gray or bluish muddy substance derived from the coal shales and sandstones that once overlaid the ore-bearing limestone. The crystals of sphalerite or zinc blende occur in this material. The process of concentration is therefore simple, consisting of a washing or jigging operation by which the heavier particles of blende are separated from the lighter fragments of chert and the mud. This mud is often hardened and toughened by a secondary silicification, which renders the process of concentration more difficult and expensive. The silicification is very pronounced in certain localities, notably at Galena, where the orebody is usually so hard and resisting that little or no timber is required to support sides and roof. The large rounded and more or less angular fragments of country rock frequently accompanying or underlying the ore, are known locally as 'boulders,' and the dark shales found near-by and capping the orebodies are called 'soapstone bars.' They are, of course, not soapstone and bear no mineralogical resemblance to it. Small blocks of this material, as well as a coarse, sometimes micaceous, sandstone are found constituting part of the orebodies or breccia. As a rule, the fragmentary material constituting these bodies is angular and it is seldom water worn, the zinc blende and galena contained in the interspaces being rarely or never diffused through the mass of the material forming the breccia. Red, yellow, brown, black, and white clays are found in all the ore deposits. Generally they are plastic and quite pure, though at times loamy and sandy. In the softer and less consolidated deposits, the clays surround the fragments of chert in the breccia and have ore imbedded in them. According to Winslow, the secondary silicification previously mentioned has been subsequent to the deposition of the blende and the accompanying galena and dolomite.[4] Sometimes the solutions of secondary silica have partially dissolved the original chert and the two forms of silica shade into one another. The silicification that gave rise to the secondary cherts must have taken place at the same time as, or shortly after, the deposition of the ore.

Dolomite, other than the altered limestone, usually occurs associated with the ore deposits; it is composed of a dense mass of coarse white or drab crystals at times constituting a compact rock, but frequently existing as an incoherent soft mass resembling sand. This dolomite as a rule is contiguous to the limestone wall-rock and grows into it. Blocks of limestone are often found covered with a shell of such dolomite, formed, according to Winslow, by the action of solutions containing magnesia upon the limestone.[5] The country limestone itself is rarely dolomitic, but sometimes in the vicinity of the ore deposit it carries some magnesia, probably due to secondary action.

The essence of the question of genesis is whether the metal was derived from sources below or near the surface of the earth. If of subterranean origin, the ore deposits may be expected to extend to an indefinite depth. On the contrary, if superficial and shallow, they will be limited by the extent of the crevices, fissures, and cracks in the limestone, for in such openings alone they are to be found. The theory of deep-seated origin has had within recent years two able champions, the late Posepny and W. P. Jenney. The former was an eminent authority upon questions of economic geology, but he never visited the Joplin region, and obtained his information at second hand. Dr. Jenney, however, spent months, even years, in the region and should know it thoroughly. The theories of these two geologists are also in harmony with those advanced years ago for the upper Mississippi Valley deposits by Featherstonhough, Owen, Percival, and Broadhead.

Their hypotheses may be briefly outlined in a general way as follows: At some distant period in the earth's history, the Carboniferous limestone, together with the underlying sedimentary and crystalline rocks, was disturbed, cracked, and dislocated, either by the natural shrinkage of the earth's crust or by some interior pressure, producing faults and cracks that followed more or less well-defined zones, running northeast-southwest and northwest-southeast. These cracks or fissures extended through the underlying sedimentary and crystalline rocks deep down in the earth. At a subsequent period, probably not distant from the time when the disrupting forces were at work, hot waters under high pressure and bearing the metals in solution, ascended through the openings from the interior. Upon coming in contact with the carbonaceous materials of the lower Coal Measures or some other suitable precipitating agency, or else by a relaxation of pressure, a chemical reaction took place and the metals were deposited in these cavities and crevices in the form of sulphides of zinc, iron, and lead.

With the exception of Percival, the older geologists referred to the subject in a very general way and seemed satisfied to dismiss it with a few words, attempting no elucidation of such an obviously important, though obscure, matter. We must bear in mind, however, that the science of geology in general and that of economic geology in particular was in a very crude state forty or fifty years ago. Furthermore, the country in question was then practically a wilderness not thoroughly known even in a geographical sense.

Featherstonhough, arguing from the presence of red clay in the superficial lead deposits of southeastern Missouri, says, "All these circumstances seem to point to the projection of this metallic and mineral matter from below."[6] Owen's views were based upon general considerations, and are decidedly vague. He expressed his belief in the deriva-

[4] *Trans.* A. I. M. E. Vol. XXIV, p. 647.
[5] *Ibid.*, p. 648

[6] 'Geological Report of the Examination made in 1834, of the Elevated Country between the Missouri and Red Rivers.' Washington, 1835, p. 50.

Erecting a New Mill at Joplin.

A Keystone Drill Prospecting New Territory.

tion of the ores from beneath and implied they were in some way due to the fact that they are "based upon a syenitic and granitic platform lying somewhere between one thousand and two thousand feet below."[7]

Percival's studies appear to have been confined to the lead and zinc deposits of southwestern Wisconsin. In a general way the same geological facts apply to all the numerous and extensive lead and zinc deposits of the Mississippi Valley. Percival was most impressed by the evidence of fissures, faults, and dislocations in the ore-bearing region he examined and their probable bearing upon the deposits, for he says: "The opinion expressed in my former report that the mineral was derived from beneath, is strengthened not only by the general results of my observations in the diggings, but by the appearance of disturbance in the strata, particularly along the line of the great body of mineral traversing the middle of the district, and by the relation in the bearing of that body to the extensive ranges of primary and metamorphic rocks toward the northeast, indicating that the mineral may have arisen from a mass of such rocks beneath the secondary strata."[8]

Posepny, in his excellent monograph upon the 'Genesis of Ore Deposits,' draws his deductions from what he saw at the only deposit he visited in Missouri, if not in the whole Mississippi Valley, the Mine La Motte in Madison county.[9] He thinks it inconceivable that such deposits, consisting wholly of sulphides, could have any other than a subterranean origin. Referring more particularly to the Wisconsin zinc and lead, he finds the great thickness of limestone and sandstones underlying the productive horizons not a conclusive argument against their deep-seated origin, and suggests that the solution may have effected an upward passage through the sandstone of a distant point not yet exposed.

Jenney claims to be able to recognize systems of fault that cross each other in different directions and which serve as channels for the up-flowing of metallic solutions from below. He says: "Faulting and disturbance of the strata are the controlling factors influencing the localization of the lead and zinc ores throughout the Mississippi

[7] 'Report of a Geological Exploration of part of Iowa, Wisconsin, and Illinois, etc., etc., in 1839.' Washington, 1844. Also, 'Geology of Wisconsin,' Vol. IV, p. 367.

[8] 'Second annual report on the Geological Survey of Wisconsin,' Madison, 1856, p. 63.

[9] *Trans.* A. I. M. E., Vol. XXIII, p. 304.

One of the New Districts Southwest of Joplin.

Valley. This is true as well for all metalliferous formations in all the mining regions of the globe, so that the law may be stated as universal, that all workable deposits of ore occur in direct association with faulting fissures traversing the strata, and with zones or beds of crushed and brecciated rock, produced by movements of disturbance. The undisturbed rocks are everywhere barren of ore."[10] While this general law may be accepted, with exceptions, it does not follow that when orebodies are found in faults, fissures, and disturbed strata, they must necessarily be derived from below. If in one instance such disturbances provided receptacles for the deposition of the ore when derived from subterranean depths, they would in another case be equally available when these sources were closed by underlying impervious rocks and the metallic solutions came from above. It must be clear, therefore, that the mere existence of faults and disturbed zones, such as are found but to a relatively slight extent in the Joplin region, is not a conclusive evidence of the derivation of the orebodies from below.

Jenney contends there are no evidences of the formation of lead and zinc ores taking place in the mines at the present day, hence he concludes that the deposition of the ores has long since ceased, and that it must have occurred at a definite period when the subterranean circulation of waters in the strata and the conditions influencing and affecting the formation of the orebodies were radically different from those now existing. While it is reasonably certain that the conditions are now different, it is doubtful if we have a right to assume that the deposition of sulphide ores has ceased, for I have frequently seen abandoned tools taken from old workings at Joplin and Galena more or less completely covered with crystals of blende.

According to C. R. Keyes, recently State Geologist of Missouri, the zinc ores are found in all the geological formations from the Second Magnesian limestone through to the Upper Burlington, but they are not equally distributed. Only four productive horizons for lead and zinc are recognized, and they are the Upper Burlington limestone, the Hannibal shale, the First Magnesian and the Second Magnesian limestones, their relative productiveness being in the order named. All the other horizons are virtually barren.[11] He states his belief that the ore and gangue that fill the fissures have come from below in solution in hot alkaline waters. The more open and porous the rocks through which they pass, the larger and richer the orebodies; consequently, the harder and more compact the formation, the poorer or smaller the mineral deposit. Thus the great breadth of the orebodies and their remarkable richness in the Upper Burlington limestone is accounted for by the porous nature of the rock and the readiness with which water enters the cavities in it. The various heavy 'runs' of mineral in this formation are contained in shaley and more porous layers. In striking contrast to the rich deposits of the Upper Burlington is the barrenness, in this area, of the Lower Burlington, which immediately underlies it. In the latter formation are found all of the most unfavorable conditions for the accumulation of an orebody. The hardness and compactness, both of the limestone and chert, have made it impossible for the ore-bearing solutions to penetrate more than a very little beyond the limiting walls of the original crevice.

(TO BE CONTINUED.)

[10] *Trans.* A. I. M. E., Vol. XXII, p. 642.
[11] Missouri Geological Survey, Vol. XII, p. 162.

The Prospector.

Enquiries sent to this department are answered free of charge, if submitted by subscribers who are not in arrears. The full name and post-office address of the sender must be given, otherwise no answer will be made. Those who are not subscribers must accompany their questions with a fee of $3 for each question. No assays are made.

NOTICE.—Owing to the large number of specimens forwarded to this department, it has been found necessary to make a charge of 25 cents (to subscribers) for each determination, in future.

A specimen of olivine diabase was received from A. M. W., of Amador City.

A piece of pyritiferous shale of no value was sent by J. P. M., of Basslung, Washington.

A piece of volcanic breccia stained by hematite came from Rosebud, Nev., marked A. S.

The oxides of manganese, pyrolusite, and psilomelane came from Big Oak Flat, Cal., marked L. F.

The specimen of quartz sent by M. F. B., of Boston, Mass., contains pyrite, galena, and gray tetrahedrite.

The specimen from H. C., San Francisco, is opal with red cinnabar and small radiating needles of millerite.

Specimens from Santa Barbara marked S. C., are: No. 1, biotite-gneiss; No. 2, schist with pyrite; No. 3, volcanic tuh.

Specimens from Jerome, Ariz., marked A. G., are: No. 1, banded jasper; No. 2, chloritic gneiss; No. 3, diorite; No. 4, serpentinized rock containing pyrite.

The specimens from Cannonville, Utah, marked C. C. W., are: No. 1, mineral resin; No. 2, oil shale. Their value can be determined only by a field examination.

L. H. G., of Berkeley, sends: No. 1, andesite; No. 2, quartzite; No. 3, granite; No. 4, slate; No. 5, limonite and calcite; No. 6, quartzite; No. 7, altered rock containing pyrite; No. 8, quartz-porphyry.

D. C. F., of Tonopah, sends minute crystals of colorless fluorite with the rare combination of forms, octahedran (111), cube (100), rhombic dodecahedron (110), trapezohedron (311), tetrahexahedron (10.3.0), and hexocathedron (10.4.3).

The samples from Callahan, Cal., marked A. F. S., are: No. 1, black manganese dioxide, psilomelane; No. 2, sphalerite in quartz; No. 3, cerussite; No. 4, galena, chalcocite, malachite, and azurite in quartz; No. 5, pyrrhotite and pyrite; No. 6, galena and sphalerite; No. 7, stibnite and pyrite; No. 8, arsenopyrite.

E. D., of Kimberley, Utah, sends a specimen of quartz containing a black alteration material, now manganese dioxide.

The Historical Development of Colorado Viewed From a Geological Standpoint.

Written for the MINING AND SCIENTIFIC PRESS
By T. A. RICKARD.

In the mining of the precious metals, Colorado holds the first place among the States of the American union. It is situated so as to cover a large portion of the continental range, which, under the name of the Rocky Mountains and the Andes, stretches through the Americas from Alaska to Patagonia. The Rocky Mountains extend through Colorado from north to south, a distance of 280 miles, between the parallels of 37° and 41° north latitude. This mountain range, which loses its boldness in Wyoming, to the north, and in New Mexico, to the south, culminates within Colorado in a great number of snowclad peaks, of approximately equal altitude, ranging between 14,000 and 14,500 ft. above sea level, the loftiest crest being that of Sierra Blanca, in the Sangre de Cristo range, which attains a height of 14,464 ft. The mines are situated for the most part, between 8000 and 12,000 ft. No precious-metal mines are at a lesser altitude than 7000 ft. The highest mine is, probably, the Present Help, on Mount Lincoln, at 14,202 feet.

A portion of Colorado belonged to Mexico until 1848. The first discovery of gold was made in the summer of 1849, but actual mining did not begin until 1859. Silver ores were recognized shortly afterward. At the end of 1907, the total production of gold in Colorado is estimated to have been worth $400,000,000, and that of silver had an exactly equal value. These figures are eloquent of the growth of the great industry from humble beginnings. It covers, historically, only a brief space of time, but development has trodden so fast upon the heels of discovery that the achievement has been possible within the life of one of the generations of man.

The discovery of the mineral deposits was associatel successively with different geological formations, the prevalence of ore in any particular rock inciting the search for gold and silver in similar rocks elsewhere in the adjoining mountains. Hence the history of the development of Colorado's mines includes the story of the gradual recognition of a succession of ore-bearing terrains.

Mining in this region may be considered to have had its beginning when John Gregory, at Blackhawk, in the Gilpin district, discovered the lode that still bears his name. This occurred on May 6, 1859. The lode traversed the granitoid gneiss of the Front range, which, flanked by battlemented cliffs of later sedimentaries, rises boldly above the dreary level of the great plains. These Archean rocks were the scene of the earliest mining activity, on account of their accessibility from the prairies and the fact that their weathered surfaces exhibited numerous outcrops of iron-stained veinstone. As the same formation occurs in the adjoining counties, it is not remarkable that the development of the Boulder and Clear Creek districts was contemporaneous with that of Gilpin.

The gorges of the mountain torrents afforded natural lines of advance to the army of prospectors. One party went up the river Platte, from its gateway through the range, and then, crossing over into the upper valley of the Arkansas, they found gold-bearing gravel in the bed of a tributary stream, which became known as California gulch. This was on April 8, 1860. One of the pioneers who participated in this event told me that he and his comrades found fragments of porphyry in the first gravel they tested. This they accounted a favorable sign, no less than the actual particles of gold, because it reminded them of similar conditions observed by them on the Feather river, in California, where they had been working previously. Little did they guess the significance which the porphyry would have in future years on account of the enormous wealth that this rock covered on the adjacent hills. The placer diggings of California gulch proved extremely rich. In the sluice-boxes pieces of silver ore were found. This led to prospecting on the hillsides above the diggings. Carbonate of lead, in the form of crystalline cerussite, was encountered amid the drift that covered the true rock surface of, what is now called, Dome hill. As a consequence of this discovery, a shallow shaft was sunk. A lode formation of silver-bearing lead ore was found outcropping under the drift. Thus was Leadville born. This occurred in the autumn of 1875. In 1887 the annual output of the district culminated in a production of silver ore valued at $13,500,000.

The ore deposits of Leadville were found to lie along the contact of limestone and porphyry. The limestone proved to be of Lower Carboniferous age and the porphyry, under the microscope, was recognized as quartz-felsite. Ore-measures of enormous extent were traced along this horizon and, as a consequence, the prospector commenced an active search for similar conditions elswhere. This led, in July, 1879, to the discovery of silver-lead ore in the same geological horizon on West Aspen mountain in the Roaring Fork district, which has since become identified with the town of Aspen. No rich orebodies were, however, uncovered at that date and the mining camp of Aspen did not rise into prominence until ten years later. In 1892 the output for twelve months reached 8,256,467 oz. of silver. During this period several parties of prospectors crossed the complex of mountain ranges occupying the southwestern corner of Colorado, and found other rich deposits of ore, also in Carboniferous limestones, where the Dolores river had cut through them. This was in 1878. A rush set in with the cry that "another Leadville" had been found at Rico. The expectation proved to be premature. It was not until October 8, 1887, that the first rich ore-mass in this locality was found on Newman hill and forthwith made Rico an important mining district.

Thus Leadville, Aspen, and Rico are linked by a similarity of geological conditions leading to a successive mining development.

Among the pioneers who crossed the San Juan mountains, to discover the ores of Rico, were sev-

eral who had previously opened up gold and silver veins in the eruptive rocks of the upper valley of the Animas river, near Silverton. From that mining camp exploring parties scattered up the tributary streams. Some of them ascended Mineral creek and crossed the divide into the watershed of the San Miguel river, where gold placers were found, and worked, in 1874. This led to the discovery, on the high range at the head of the valley, of several very persistent lodes, carrying both gold and silver and traversing a volcanic breccia. The district named Telluride thus came into existence and in 1882, by the uncovering of the Yankee Girl lode, on the other side of the range, the Red Mountain district attained prominence. The characteristic rock of these districts is an andesite breccia of early Tertiary age; it is a geological formation that has played a leading part in the history of Colorado ever since the day, in 1875, when the Sheridan vein was discovered above Telluride. This volcanic breccia caps the high ranges of the whole San Juan region, covering an area of about 8000 square miles, and consequently, the development of the two districts already mentioned was soon followed by an outbreak of mining activity upon the mountains overlooking Ouray and Ophir, as well as among all the snowclad hills that guard the source of the Gunnison and Uncompahgre rivers.

It may seem strange that the knowledge of these facts did not lead to the earlier discovery of Cripple Creek, which is likewise in an andesite breccia of early Tertiary age. This is an interesting point. The only complete geological maps of Colorado in existence are those based on the reconnaissance surveys of Hayden. They were published in 1874. Since then the United States Geological Survey has issued accurate geological maps of certain important mining districts, but these cover only selected localities covering restricted areas, so that there is no approach as yet to a complete map of Colorado. Of the Hayden maps one can only say that, considering the necessarily hasty character of the explorations on which they were founded, they are surprisingly good. They exhibit, of course, many errors of detail, but they served more than twenty-five years ago, to give, to those whom it concerned, a comprehensive view of the general geology of a complicated mountain region. On these maps the eruptives that cover the San Juan highlands are clearly shown and large patches of similar rock are marked as occurring in various parts of the State; among others there is a distinct heart-shaped area of Tertiary eruptives set down as occurring amid the granite of Pike's Peak and immediately to the south of it. That patch of Tertiary eruptive is now the Cripple Creek district.

To Pike's Peak clings the romance of the first gold excitement. It was this old beacon mountain that guided the emigrant caravans across the trackless prairie over forty-five years ago. Although no gold-veins were discovered, at that time, on the mountain itself or on the smaller hills that cluster about the central mass of pink granite, yet, the motto, "Pike's Peak or bust," written on the canvas of many a pioneer's wagon, has gone down in history as an expression of the mock-heroic spirit of those argonauts of 1859. That no gold was found in this region in the early days was due to the fact that the mass of Pike's Peak itself does not, as far as is known, even to this day, carry any valuable veins of ore, while the eruptive rocks that cover its southern approaches are shattered at surface and therefore appear as rounded grass-covered hills, which served as an excellent pasture for cattle up to the time when they were uptorn by the mining activity of a more recent period. This shattering of the superficial rock, due mainly to the action of frost at a high altitude, affected the veins also, for they are, for the most part, simply bands of fractured rock impregnated with gold. They shared the fissile character of the country and, consequently, its degradation also. The absence of outcrops is the chief reason why Cripple Creek remained so long undiscovered.

Creede and Cripple Creek were contemporaneous. Creede is on the eastern edge of the San Juan region, and in 1892, it sprang into tremendous activity, consequent upon the uncovering of several bold outcrops of silver ore in an agatized veinstone, which followed well developed fractures through a sheeted eruptive. Silver mining was the most important industry in Colorado sixteen years ago, therefore Creede was more popular than Cripple Creek. At that time the market price of silver afforded large profits to the mine owners and the search for it attracted the enterprising to an unusual degree.

In the spring of 1891 the Cripple Creek district came into existence as the result of the discovery of gold ore on a cattle range that covered the southern slope of Pike's Peak. The first finds were of no great moment. The district had been the scene of a disappointment seven years earlier, when a short-lived mining excitement had been created by false statements. Furthermore, as already stated, Creede and silver mining were in fashion and certainly offered more attractions than a discredited region over which several waves of exploration had swept in vain. Therefore, it was not until 1893, when the closing of the Indian mints caused a collapse in the price of silver and prostrated, for a time, the mining of that metal, that the energy of Colorado turned to Cripple Creek. The new district responded to the harrassing needs of a great financial crises. In 1894 the production was $3,900,000; in the following year it rose to $7,800,000, and in 1900 it culminated in an output of $18,147,681.

The old rallying call of the pioneers of 1859 was vindicated and Pike's Peak, which was once a beacon to guide the gold-seeker from the East, became destined to throw his protecting shadow over the greatest gold-mining area in Colorado. Thus has geology been woven into history and thus were the uncertain steps of a young industry upheld by two fairy godfathers—fortune and science.

An important event in 1907 was the opening up of a new source of iron ore supply at Mayari, Cuba.

Sunlight and Shadow on Dolores Mtn., at Rico, Colorado. Newman Hill and Enterprise Mine in the Middle Distance.

Victor, in the Cripple Creek District, Colorado.

MINING REGULATIONS IN CHINA.

In the Anglo-Chinese commercial treaty of 1903, the Chinese government agreed to revise the mining regulations then in force, in such a way that foreign capital could be employed under more favorable conditions. The first set of regulations submitted were so unsatisfactory that they had to be withdrawn. During the autumn of 1907 a second set was submitted to the Wai-Wu-Pu and were approved by the throne. These also are so ambiguous, conflicting, and full of restrictions as to offer endless opportunity for controversy, and it is not likely that they will be approved by the powers concerned. It may be of some interest, however, to outline their general features, in order to show what the sentiment of the Chinese government is in regard to such enterprises.

The regulations provide that control of all mining operations throughout the Empire shall be placed in the hands of the Board of Commerce and Agriculture. In each province a mining office is to be opened, under the control of a mining deputy, who must be a Chinese, although he may employ foreign experts. This office has entire control of all mining operations throughout that province. Before any prospecting work can be done, application must be made to the proper mining office for a permit, stating the locality to be prospected and the mineral sought. After investigation, a permit will be issued by the head office; this is good for one year, but may be extended for six months more in case the company has proceeded in the work with diligence and still requires more time. The area covered by a permit may not be greater than 30 *li*, and must be wholly within one district. After prospecting has proceeded to a depth of 30 ft., a mining permit must be secured from the head office. To obtain this, application must be made, stating the details of the partnership under which it is proposed to work, together with a security of 1000 *taels*,* and the name of some well-known firm as a business reference. The area covered by a mining permit is 300 ft. square, but the same company can apply for more than one, up to a total of 160 acres. No mine can be operated without Chinese partners, but where no Chinese wishes to invest capital in working, there may be an entirely foreign operating company, the holding company consisting of Chinese and foreigners.

The fees required to be paid are a ground rent for the land, a tax on the monthly output, and a further bonus upon the output from land owned by the Government. The tax on output is 1 *mace* (about 7 cents gold) per ton for coal and iron ore. On gold and silver ores it is either 5 or 10% of the value, and for tin and copper ores, 3%, while on jade and precious stones it is 10%. The land rental also varies according to the character of the mineral. In the case of government-owned land one-half of the profits of working must be paid to the Government. It is specified that where the Chinese owner does not wish to share in the risk of mining, he may accept a yearly rental for the use of his land, but in all such cases three-tenths of the shares of the operating company must be held in reserve for a period of five years, to give opportunity for Chinese to become partners in the enterprise, if they may later wish to do so.

The regulations further provide for the periodical submission of plans of the workings to the mining office, monthly reports, and the inspection of the books and records of the company. Various miscellaneous questions of public policy are further provided, some of which, if adhered to, would be almost prohibitive. For example, it is specified that mining may not be carried on within three *li* of any important waterway, road, or railway. No mine may be opened within 3 *li* of the grave of any important person, nor within 500 ft. of the grave of any person. Altogether, the regulations, if agreed to and carried out, are well calculated to discourage the use of foreign capital in mining work.

*A *tael* is $1\frac{1}{3}$ oz. avoirdupois; 1 *tael* is equal to 10 *mace*. A *li* is about a third of a mile.

Rules for Employees at Goldfield.—The Goldfield Mine Owners' Association has formulated the following rules and regulations:

This mine is to be worked under the open-shop policy of the Goldfield Mine Operators' Association, hiring and discharging men without regard to whether they do or do not belong to any labor organization, and under the following rules and regulations:

1. The time of each man on every shift belongs to this company and to no one else.

2. No walking delegate or other representative of any labor organization is to be allowed upon these premises at any time or for any purpose.

3. No soliciting of membership in any labor organization is to be allowed upon these premises at any time by an employee of this company or by any one else.

4. No discussion of labor questions, either for or against unions, or in any way connected therewith, is to be allowed during working hours, or upon these premises at any time or under any circumstances.

5. No employee of this company is to be annoyed or interfered with by any other employee in his work in any way whatsoever because he may or may not belong to any labor organization, or for any other reason, and all employees are to work together harmoniously for the best interests of the company.

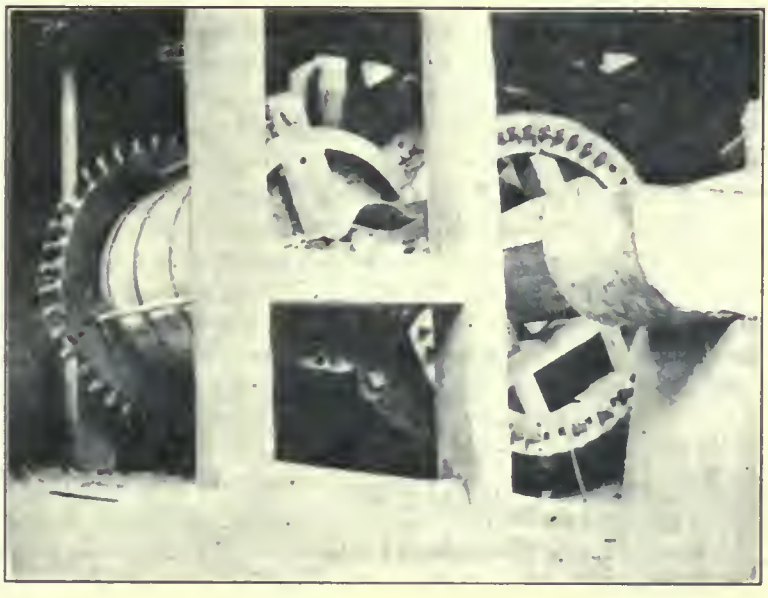
6. No employee of this company is to harass, intimidate, or interfere with any working man of the Goldfield mining district because he does or does not belong to any labor organiation.

7. All employees are requested to report any violations of these regulations to the management, and any employee found guilty of violating them, or any part of them, will be immediately discharged and be disqualified from any further employment by this company.

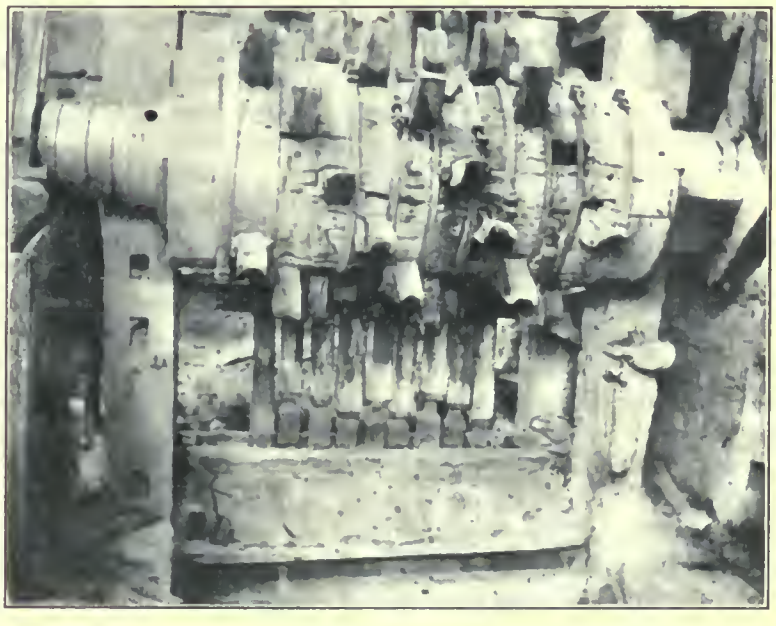
8. Any outsider violating any of these rules will be immediately ejected from the premises and prosecuted by law for trespass.

OLD WAYS.

The accompanying illustrations show one of those old Mexican mills that, by force of contrast with a modern plant, mark the progress made during the last fifty years. For the photographs we are indebted to Mr. Alfred F. Main, of El Oro, and for the few descriptive notes to Mr. Constantine G. Rickards, the owner of the property on which the old mill stands. It is in Oaxaca. The ten stamps are of wood, shod with iron. With the exception of the shoes, all other parts—such as cams, tappets, shafts—are of wood, and connected directly to a wooden water-wheel 18 ft. in diameter. Even the driving gear of the amalgamating barrel and the cam shaft are of wood. The cam shaft is lubricated in its bearings with a stream of water. After being pulverized, the ore goes for treatment by the Patio process. About 50 tons of finely pulverized ore are laid out on a floor and mixed with water to a suitable consistence. The resulting pulp is then well mixed with from 2 to 4% salt, the mass being left untouched for a period in order to admit of the solution of salt and the decomposition of the ore. Subsequently to this, the cake or *torta* is trodden by means of horses, so as to expose it to the air. A small percentage of copper sulphate, which has the effect of assisting the process, is added, after a proper proportion of quicksilver has been strained through canvas over the mass. This process occupies from 20 to 30 days, the mass of pulp or *torta* being continually trampled by horses and turned over by spades, a number of samples being taken daily and washed in a small earthenware dish, in order to ascertain the condition of the amalgam, an experience only to be acquired by considerable practice. As soon as the silver is found to be sufficiently amalgamated, the whole mass is submitted to a washing process, by means of which the amalgam and waste material is separated. The amalgam is then squeezed through canvas bags, in order to remove the excess of quicksilver, subsequently retorted, conveyed to a small Spanish reverberatory furnace and run into bars.



Wooden Gear.



An Old Stamp-Mill in Oaxaca.

GAS ENGINES RUN BY GASES FROM COPPER FURNACES.

The Mansfield company of Germany has for some time past been utilizing the blast-furnace gases from the copper furnaces at the Krughütte works for direct consumption in gas engines. The blast-furnace gas has a heating power of 650 calories per cu. m.—the proportion of carbon monoxide being 21.65%—and as the volume of gas amounts to about 21,000 cu. m. per hr. the available power from this source, when used in gas-engines, is between 4400 and 4500 hp. Owing to the lessened output when any of the furnaces have to be cleaned and also owing to variations in the calorific power of the gas, the mean of 2700 hp. is all that can be depended upon. The furnaces are connected up to two gas-mains—one about 62 in. diam., the other 39½ in.—either of which can be disconnected for cleaning or repairs. Before reaching the engines the gas has to be freed from dust, for which purpose it is passed through counter-current washers; these consist of spiral blades, rotating at a peripheral velocity of about 165 ft. per sec. In passing through the apparatus the gas is brought into intimate contact with water, which is sprayed by the action of the blades and forced in the opposite direction to the flow of gas. After being dried, the gas, which now contains only about 0.003 gm. of dust per cu. m., against 17 gm. in its original condition, is led to a gas-holder capable of storing 18,000 cu. ft., whence it passes to the engines. These are two in number, each of 1300 hp., a third engine of equal capacity being in course of erection. Each motor is of the two-cylinder class, with fly-wheel mounted on a common shaft between the halves, and each develops 1300 hp. when running at 125 revolutions and driven by gas of the above-mentioned calorific power. The cylinders are water-cooled, the effluent water being pumped up into a cooling tower and thence returned to the supply tanks. The fly-wheels constitute the rotors of the three-phase Siemens-Schuckert generators, developing 1080 kw. at 3000 volts tension.—*The Mining Journal.*

HANG FIRE.

By William Maurice.

*In view of the fact that four pit sinkers are reported to have been injured at a Sunderland colliery so recently as October 24 owing to the unexpected explosion of a blasting charge, it may prove of some service to the mining community to point out that electric detonators can and do at times hang fire. Under the Quarries Act, "If a shot has apparently missed fire, no person shall be allowed to go near it until after the lapse of half an hour, except where electricity has been used," and in coal mines an electrical miss-fire is exempted from the regulation as to fixing of caution boards or fences. It cannot, therefore, be too well known that such regulations are misleading and liable to cause accidents. In the case referred to, it would appear that the explosion was due to a simple miss-fire and subsequent detonation by a blow from a pick, though the report calls it a "serious hang-fire."

It is not unusual for one in a group of simultaneously fired shots to miss, and consequently there is always an element of danger in group-firing. Probably a nearer approximation to perfect safety would lie in the use of electrically ignited time fuses, though it must also be admitted that the use of a suitable detonator would go a long way toward ensuring the simultaneous ignition of any number of shots. Hang-fire, or retarded ignition, may occur in the electric detonator or it may occur in the explosive. A damp detonator might readily hang fire.

It is well known that a shot will sometimes explode after prolonged turning of the exploder handle, whereas in general less than half a turn will suffice. The retardation might be caused by increased resistance in the circuit through broken wires, bad joints, or grease or dirt on spring contacts and terminals, permitting the passage of only just sufficient electrical energy to warm the fuse bridge. The latter has then to be kept heated during several seconds before the temperature rises to the point of ignition of the priming. The same effect would be produced if the exploder were under-powered, owing, for instance, to loss of magnetism. Or delayed ignition might be caused by defects in the fuse, such as badly mixed, damp, or insufficient priming, or by a wet charge.

Capt. Desborough states that he had electrical hang-fires when firing experimental shots with three different ammonium-nitrate explosives, that of greatest duration involving an interval of about 50 seconds between the explosion of the detonator and the explosion of the charge. With all these explosives he subsequently had several miss-fires, and in each case, when the charge was extracted, he found that the detonator had fired, but had failed to explode the charge. The difficulty was overcome when a stronger detonator was employed. In this connection Capt. Desborough mentioned that a cartridge of carbonite was found to be burning in a shot-hole in a colliery in South Wales. This was by no means the first instance of the kind, and the cause seemed to lie in the use of a faulty or insufficiently powerful detonator.

The Annual Report of the Inspectors of Explosives for 1906 also records three cases in which a hang-fire has occurred with electric firing. In one of these cases two attempts were made to fire a shot electrically (high tension); the cable was then disconnected from the detonator leads and tested. It was found to be all right. The shot then exploded. There is practically no doubt, says the report, that this was a case of hang-fire. The time elapsing between the disconnection of the cable and the explosion of the charge was about five minutes.

Dynamite, guncotton, nitrate of ammonia, and other blasting materials containing nitrates, decompose gradually in the air, and give out nitric oxide, but if they are ignited in a closed space they instantly decompose, without forming a trace of nitric oxide. The first slow process changes immediately into the second if the free evolution of gas be hindered and the pressure raised. The reaction produced by a detonator is the same as that by ignition in a closed space at high pressure. Both are so rapid that the whole of the charge is at once converted into gas. But if the ignition be defective, the charge may ignite and burn instead of exploding; it is then said to 'cook,' and gives off nitric oxide. The explosive power of a charge also varies with its composition, and depends, in grisounite, upon the small quantity of nitro-napthalin that it contains. If the charge begins to burn, the increasing pressure caused by the gases given off may produce an explosion and ignite the cartridges one after the other.

*Abstracted from *The Quarry*.

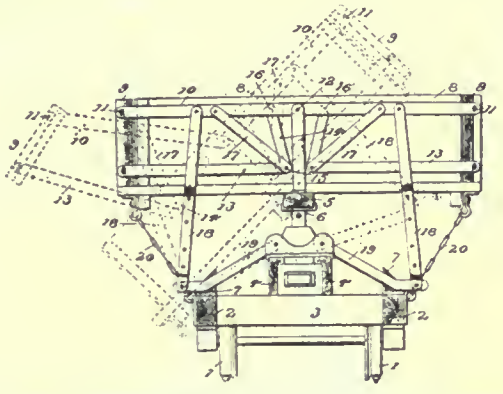
Tantalite in Australia.—In the Wodgina district in Western Australia a tantalite-bearing dike of pegmatite has been found near McCarthy's creek. In places the dike is almost entirely composed of the soda feldspar albite, while elsewhere it is very largely quartz. Tantalite is very freely visible in the albite, in coarse pieces, often many pounds in weight. By ground-sluicing below the dike some heavy lumps have been obtained, one weighing about 500 lb., evidently derived from the weathering-down of the pegmatite. The quantity of tantalite produced by the placer mining is 34.1 tons. The mines were worked energetically for a short time until the consumers' stocks were filled and then the mineral could not be sold. The industrial uses of tantalite are at present very limited and the demand for the mineral small.

Uses of Ground Mica.—Ground mica is used in somewhat increased quantities, the coarser grades in mica bronzes and paints, and also as an absorbent for explosives. Ground mica also forms an ingredient in some heavy lubricants. The finest ground mica, or mica flour, finds a considerable market with the manufacturers of high-grade wall paper, the lustre obtained by the use of the muscovite dust having the advantage of both permanency and brilliancy. Specked mica is seldom used for grinding where a good grade of ground mica is desired, since it spoils the color and quality of the latter.

MINING AND METALLURGICAL PATENTS.

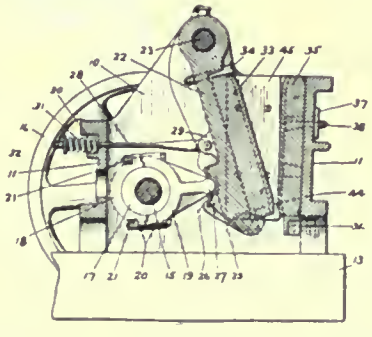
Specially Reported for the MINING AND SCIENTIFIC PRESS.

DUMP-CAR.—No. 874,519. Edward S. Maclin, Knoxville, Tennessee.



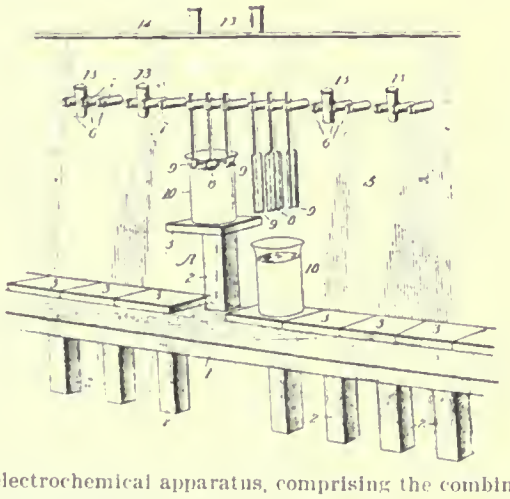
In a dump-car or similar structure, the combination of a car-body having a displaceable wall, a toggle connecting said wall and a relatively fixed part of the body, and a link connected to said toggle to forcibly spread the same upon dumping of the car.

ROCK-CRUSHER.—No. 873,081. Edwin S. Phillips, Kennett Square, Pennsylvania.



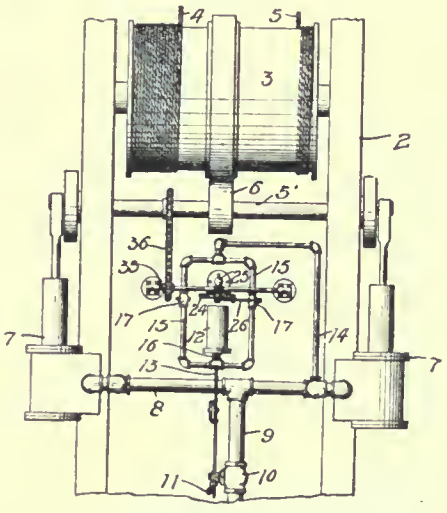
In a rock-crusher, the combination with the moving jaw and a shaft from which the same is pendulous, and the fixed jaw, of the main shaft, a cam thereon, a strap on the cam having a removable section and a toggle on the removable section of the strap, said toggle having a rounded head, there being a cup-shaped recess in the moving jaw, and a wearing plate of substantially uniform thickness having its central part dished in to conform on one side to said recess and on the other side to the rounded head of the toggle.

APPARATUS FOR ELECTRO-CHEMICAL ANALYSIS.—No. 870,674. George A. Guess, Silverton, Colo., and Herbert E. T. Haultain, Nelson, British Columbia.



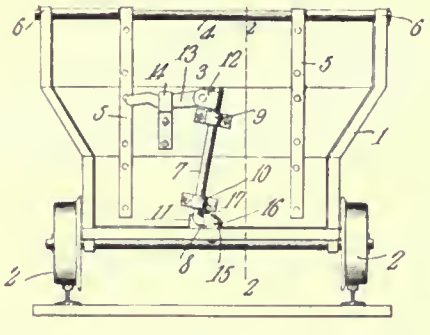
An electrochemical apparatus, comprising the combination of three terminals in a set, slit longitudinally, and an independent electrode arranged in the slit of each terminal and frictionally held thereby, the electrode in the middle terminal adapted to receive the deposit and the several terminals connected up in circuit.

ATTACHMENT FOR HOISTING-ENGINES.—No. 878,218. Harry Maker, Hibbing, Minnesota.



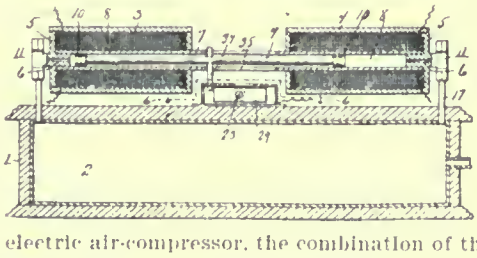
The combination, with a hoisting drum, having a cable wound upon each side of the centre thereof in opposite directions, a driving shaft geared to the middle portion of said drum, engines having their pistons connected to the ends of said driving shaft, a transverse pipe connecting the cylinders of said engines, a fluid pressure supply pipe leading into said transverse pipe, a throttle valve having a suitable lever and located in said supply pipe, a cylinder, a piston therein connected with said lever.

LATCH FOR MINE-CAR DOORS.—No. 874,872. Christian H. Smith, Tranger, Pennsylvania.



Combined with a door, an inclined latch bar having a laterally projecting tapering finger on its lower end, bearings for said bar, parallel arms on said bar above and in contact with said upper bearing, a lever pivoted between said arms and a keeper on said door for retaining the latch in closed position.

ELECTRIC AIR-COMPRESSOR.—No. 878,260. Nelson M. Watson, Detroit, Michigan.



In an electric air-compressor, the combination of the reciprocatory plunger, the air cylinder within which said plunger works, an air reservoir, means connecting said reservoir with said cylinder to afford a passage for the air, an electric circuit including an electro-magnet for reciprocating said plunger, means actuated by the plunger in its movement for cutting said magnet into and out of circuit, and means connected with the cylinder and actuated by fluid pressure for opening said electric circuit.

METAL BELT-LACING.

It is generally noted that at the present day steel belt-lacing is superceding the old style method of common string lacing that had been used to unite the ends of belts. It is difficult and at times impossible to make a durable conjunction with the ordinary string lacing. Many experiments have been made with wire lacing and various forms of iron hooks, to obtain strength and durability. These several methods are still in wide use. However, all seem to be working toward a lacing that will give at once an elastic joint, requiring no tools to apply, able to stand the strain and still have a smooth light appearance, enabling it to pass without jar or slip over the lightest pulley.

A popular and widely used metal lacing is made by the Bristol Company of Waterbury, Conn. A complete line is made of over 100 different sizes, suited to all kinds, widths, and thicknesses of belting; this marks a notable advance for in the beginning this lacing was made only for leather belts as shown in Fig. 1, showing the lacing ready to apply and the finished joint. Encouraged by success, different

Fig. 1

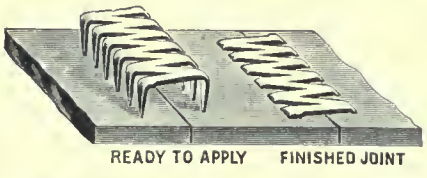


Fig. 2

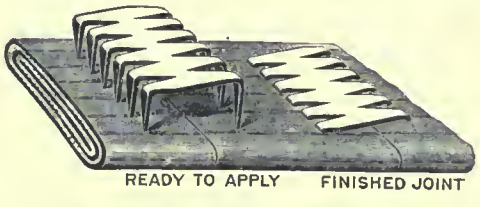
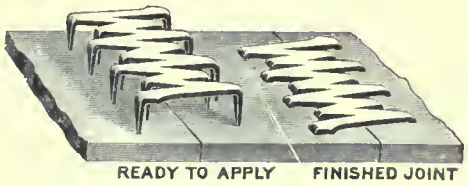


Fig. 3



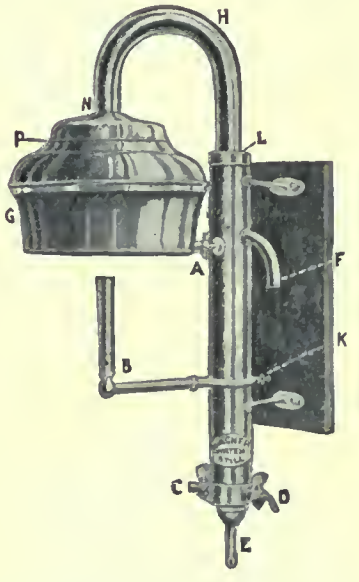
styles were added (as Fig. 2) for cotton, rubber, and woven belts, and later a lacing designed for general use having a staggered point (Fig. 3), which in large sizes has been found to be the only thing that will adequately join a conveyor belt. This lacing is made of the toughest cold-rolled steel cut into a continuous zig-zag form, and so proportioned as to give maximum strength with a minimum amount of material. The wedge-shaped points when driven through the belt, force the fibres aside without cutting them, hence the ends of the belt are not weakened, as when holes are punched. The lacing makes a smooth and elastic joint and is easily and quickly applied without any special tools, the spurs being driven through upon a piece of soft wood after the ends of the belt to be joined have been brought evenly together. The belt is then turned over upon the pulley or any convenient piece of iron and spurs clinched, bending them toward the joint.

The lacing is furnished in lengths varying from one to three inches (No. 1 by quarter inches), it being always possible from a box of assorted lengths to find two or more pieces of lacing which, together, may be used for a belt wider than three inches. For rubber, cotton, and woven belts the space between the spurs is a trifle greater than in the corresponding sizes designed for leather belts: thus a better grip is obtained on the fibrous end of such belts. For both leather and cotton belts the staggered point will answer the general need and combines the best features of the other two styles.

The Bristol Company now has machinery that enables it to turn out 1200 boxes per day, and a large addition to plant and machinery is now being made to take care of the continually increasing business.

WAGNER WATER-STILL.

Few people, aside from professional men, appreciate the value in the matter of health of absolutely pure distilled water. Filtered water is not pure and disease germs are not destroyed or eliminated by ordinary filtering processes. Much of the distilled water in bottles tastes 'flat,' but this objection to the use of distilled water for drinking may be removed by the employment of the new Wagner Automatic Water Still, the patent rights to which are controlled by the Wagner Water Still Co., of Chicago, Illinois. This device is in no manner to be compared with the cumbersome, ungainly, and laborious stove still, with its consequent care of refilling with water at frequent intervals,



making it a source of annoyance and hardship to the housekeeper. It is simple in operation, of convenient size, and can be attached above any sink or lavatory. The Wagner still can be operated all day or one hour per day, as desired; it requires no refilling with water—it re-fills itself automatically at all times. It is made in four sizes of capacity respectively, of ½ gal. per hr, 1 gal. per hr., 1½ gal. per hr., and 2 gal. per hr.; the ½ gal. per hr. capacity is the accepted household size. This device may have solved the drinking water problem, as it delivers absolutely pure, cold, aerated, distilled water at a minimum cost.

AN IMPROVED WATER-LEVEL GAUGE.

It is often advantageous in hydraulic engineering to automatically register the fluctuations in height of water, in head and tail-races, rivers, reservoirs, canals, sewers, forebays, etc. Many devices have been used for this purpose, but in practice, troubles have resulted from mechanical complexity, difficulty of installation, and the effect of cold weather on this apparatus. These objections have been overcome in the Bristol water-level gauge by using air-pressure for transmitting the motion. A double bell casting is placed permanently at the lowest point to which the water will fall. Between the halves of the bell a diaphragm of thin sheet rubber is placed so that the water pressure below compresses the air above, this pressure being transmitted through a flexible copper tube to the recording portion. It is seen, therefore, that all moving parts have been eliminated except the rubber diaphragm, which is permanently placed below the freezing point in the water. The recording portion may be put at any convenient distance from the water, and can be equipped with either daily or weekly charts of almost any capacity. These recorders have also been developed for registering the depth of volume of oil in fuel-oil or storage tanks. They are made by the Bristol Company and described in their new bulletin, No. 69, which will be sent upon request from the nearest office—New York, Chicago, or Waterbury, Connecticut.

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Editorial.

OUR CONTEMPORARY, *South African Mines*, has resumed its old name, *The S. A. Mining Journal*, which it bore in the days before the Boer war. The proprietor, Mr. Clem D. Webb, is to be congratulated on the useful work his paper is performing for the mining industry of the Transvaal.

WHILE opposed to the hippodroming that masquerades in the guise of mining, we are glad to chronicle any new discoveries; therefore we print a good photograph showing the appearance of Rawhide, the scene of the recent rush in Nevada. A letter from our correspondent, Mr. Algernon Del Mar, gives the latest news. At an early date we expect to publish a more critical account.

REDUCTION OF DIVIDENDS by the Calumet & Hecla, American Smelting, Amalgamated, Federal Mining & Smelting, and other representative industrial corporations has now given the measure of the decrease in profits due to the fall in the prices of metals, itself the consequence of a general commercial depression, the inevitable sequel of over-expansion of credit and reckless speculation. The actual shrinkage in copper profits, whether from mining or trading, amounts to nearly 75 per cent as compared to the maximum attained a year ago, and it affords a striking commentary on the confident assurances given by insiders when copper was selling at 26 cents per pound.

THE ARTICLE on 'Crushing Ore' by Mr. M. P. Boss is likely to prove interesting to many readers, for Mr. Boss is a veteran millman, who has done a great deal more than merely write on this subject. As the inventor of the continuous-pan system he is well known to silver miners, and in more recent years he did much to develop the metallurgical practice of the Pachuca district, in Mexico, blazing a metallurgical trail for the younger men, who are now invading the habitat of the patio process and applying cyanidation to the ores of Real del Monte.

IN THIS ISSUE we publish a condensed account of the recent rock-drilling contest on the Rand. It was an interesting competition, due to the enterprise of our contemporary, *South African Mines*, a weekly journal published at Johannesburg. The prize of $500 was won by the Gordon drill, named after a former American consul at Johannesburg, invented by Messrs. Hellman and Bayles, and manufactured by Fraser & Chalmers, the representatives of the Ingersoll-Rand Company. This drill has been used in the Robinson mine for a year, and has enabled the cost of mining to be reduced to a notable degree.

Having regard to the weight of the drill and the amount of air consumed, the work accomplished by the drill was extremely creditable. It is fair to add that the Hardsoeg Wonder drill was prevented, by the misfortunes of the operator, from entering into actual competition, and one or two other drills of acknowledged usefulness were not represented in such a way as to afford a general test. Moreover, the heavy drills of the percussive type were under a disadvantage, the whole purpose of the contest being to ascertain the drill best fitted to replace Kaffir labor in narrow stopes following the angle of the quartz ore of the Main Reef Series. It is a notable triumph for the drill of the hammer type.

WE NOTE, with pleasure, that the Government of the United States has decided to proceed no further in the case against the Mountain Copper Company. The litigation grew out of complaints against damage supposed to have been done by smoke from the smelter at Keswick, in Shasta county, California. The trouble began in 1897, and in 1898 the Circuit Court granted an injunction, against which the Mountain Copper Company took an appeal. The decision of the lower court was reversed, and thereupon the Government appealed to the United States Supreme Court. No decision was reached, for the Government has now withdrawn its case, the smelter company agreeing to pay $25,000, the amount of money measuring the damage supposed to have been done to the timber land above Keswick. The Company has always expressed its willingness to pay for actual damage done to the forest reserves and, apparently, the Government has taken the Company at its word. In the meanwhile the smelting industry of Shasta county has grown enormously and is the mainstay of a large population. Local sentiment has veered and there is every inclination to treat the smelting companies fairly, but this reasonable state of mind did not supervene until after the Mountain Copper Company had moved its smelting operations from Keswick to Martinez.

SPEAKING OF ORE-STEALING, it may startle some of our readers to be told that trustworthy information warrants the statement that fully $1,000,000 worth of ore was stolen during the past year from the workings of the Goldfield Consolidated Mines Company, in Nevada. The 'high-grading,' as it is termed, was carried out on a large scale and through a great variety of channels. Detectives have been put to work and shipments of stolen ore had to be detained at Salt Lake, Denver, and San Francisco, pending further enquiry. Some of the local police were in league with the thieves and facilitated the trade in stolen ore. A cyanide plant, with a small roaster and leaching vat, was found next door to the office of an under-sheriff. Scores of bogus assaying establishments did a lively business with 'high-graders' and shipments of the product were sent to the outlying districts to be returned as the yield of other mines. A large part of the $1,000,000 that was stolen will be credited to mines in other Nevada camps. In some cases elaborate schemes were concocted to divert suspicion. Ore was shipped in women's trunks and holes in the ground were bought to serve as blinds. Speaking of thefts of this kind, we are reminded of a fatality that occurred at Telluride, in Colorado. A mill-hand who had stolen some amalgam retorted it early one morning in the basement of his house and the fumes killed his sleeping wife and two children in the room overhead. At Butte another amalgam thief hired a wagon and a pair of horses, to go into the mountains and retort his amalgam. He was careless as to his team and salivated both horses.

A Financial Farce.

RAWHIDE appears destined to illustrate most of the bad features of mining misadventure, while emphasizing the wonderful energy of the exploiters of mineral wealth. Rich ore has been found, a stampede of gold-seekers has ensued, and on the basis of a few promising prospects there has been constructed a fearful fabric of flamboyant speculation, reckless company-mongering, and downright misrepresentation. There are plenty to say soft somethings and inane nothings concerning these travesties of mining, there are plenty of papers willing to sell their advertising pages, if not their editorial columns, to the predatory mob of promoters, pseudo-experts, bucket-shop gamblers, and touts. It is the province of the journals devoted to the real advancement of the great industry of mining to speak out plainly, and it is to the interest of Rawhide itself that all this slime of flapdoodle be separated from the few particles of truth available at this time. Exaggeration, misrepresentation, and buncombe will not make a mining camp prosperous: on the contrary, they deter the commencement of the actual work that makes a mine out of a hole in the ground. Thus, for example, the three pages published in the San Francisco *Chronicle* last Sunday under the title of a 'Market Review of Nat. C. Goodwin & Co., Mine Operators and Stock Brokers,' can have no other effect except to discredit the new district in the eyes of any experienced man. It is said that "several geologists and mineralogists of national reputation * * * without exception declare that all indications point to the permanency of the ore deposits." This is pure and unadulterated fabrication. No such men have said any such thing. There is no evidence to warrant anyone in predicting the persistence of the deposits. That can only be proved by mining, not by 'market letters.' Then we are told that "the genesis of the ores is three-fold, viz: stock-works, impregnation, and replacement." This is balderdash, mere jargon intended to impress the ignorant public. It is more nearly true that the genesis of this scheme is stock-jobbing, working the public, and the replacement of the money of the many into the pockets of the few. Next, it is asserted: "That some of the largest bodies of high-grade ore ever discovered in the world exist in these hills is now conclusively demonstrated." That is the vapor of words, for not enough work has been done to

prove anything, and it is on this very absence of proof that these schemers base their talk of potentialities of wealth. It is claimed that the gold has been deposited by ascending solutions and that it is associated with silver, therefore it is doubly certain that the deposits are 'permanent'—meaning persistent. It would be wearisome to quote further, but this kind of 'market letter' is a good example of the misuse of a smattering of scientific terms to cloak wholly unscientific statements. It reminds us of the superintendent who wanted to know how 'metasomatic' was spelled and, when told, he was asked why he needed to spell it. He replied: "Oh, I just put in a few of those words to play up to the directors; they like it; it sounds fine." But all this childish nonsense is only part of a game, the purpose of which is obvious. We pass on to a more serious aspect of the case. Mr. Goodwin is, or was, widely known as a clever actor. It was worth the price of a theatre ticket to see him interpret the vagaries of human nature, and now, having made an honorable name as a legitimate actor, he lends that name to a financial farce. Mr. Goodwin's opinion on a mine is worth as much, not a bit more or a bit less, than that of any other man wholly inexperienced in mining; he is lending his name as a lure to catch the people who know him to be a good actor and do not know that he is utterly ignorant of mining. It is the old story, the story of using the names of people of title, celebrities, and notorieties in order to bait a stock scheme. The Earl of Dufferin, Admiral Melville, the Governor of Nevada, a whole lot of deluded and deluding men have played their part in the comedy of errors that ended in a sordid tragedy. It is bad acting and pestilent finance.

Mining Law.

REFORMATION of the mining law is the subject of an interesting letter from Mr. E. A. H. Tays appearing on another page. Evidently our contributor has his eye on the Mexican law, for he suggests amendments that would cause the American law to resemble that of our southern neighbor. The law of the apex is open to severe criticism, undoubtedly, but it has become the fundamental concept of our statutes, and any change to acreage without extralateral rights would mean a radical transformation throughout the multiple regulations enacted by the Federal, State, and District authorities. It is not one enactment that will have to be changed but the basic principle of all the legislation on the subject. For instance, the right of discovery: this is the first privilege of the prospector and miner; by finding mineral in place he is privileged to acquire the right to so much of the length of the lode and to an indefinite depth. Now, change from apex to acreage: the discoverer delimits a certain number of acres or square feet, not knowing the dip of the ore, the shape of the orebody, or the final significance of the outcrop. These factors are ascertained by subsequent mining; at the time of the discovery they are unknown. Acreage may constitute a farm, it does not make a mine. Again, a large part of the public domain has been alienated; if you try to apply a new law side by side with the facts created by the old law, if the apex claims abut and adjoin the acreage locations, then you have confusion worse confounded, and the regrettable litigation of today will be succeeded by conflicts so complex as to make existing evils look like heavenly peace. Of course, no new law could be make retro-active, for that would be an invasion of constitutional rights. Even a location—let alone a patent—is the result of an invitation by the Government to the miner to exercise certain privileges that cannot be withdrawn without congressional amendment of the most radical character. Only in absolutely new territory, where the miner has made no entry, could a new law be applied. How much of such territory is there? Is there enough of it to warrant the subversion of customs already deeply rooted in the great mining regions of America?

Mining and Metallurgical Societies.—I.

MANY of our friends in the profession have been invited to join in the organization of a Mining and Metallurgical Association, on the initiative of Mr. H. M. Chance, of Philadelphia. Among those who have become charter members are L. S. Austin, H. Foster Bain, J. Parke Channing, J. Morgan Clements, E. L. Dufoureq, S. F. Emmons, J. R. Finlay, F. Lynwood Garrison, W. R. Ingalls, John D. Irving, James F. Kemp, Waldemar Lindgren, George W. Maynard, F. J. H. Merrill, Forbes Rickard, J. E. Spurr, and Pope Yeatman. In a recent issue we discussed the proposed professional blue-book and we are glad to learn that this feature of the undertaking is likely to be dropped. There remains the larger scheme. We have been asked to express an opinion concerning it, and as any such new departure is keenly interesting to most of our readers, we venture to speak frankly.

The members of the mining and metallurgical professions, among whom are included the economic geologists, feel the need of an organization so constituted that membership will have a meaning and so managed that expression may be given to opinions concerning professional ethics and national questions as they affect either the mining industry or the welfare of those engaged in that industry. For instance, the question of a Federal Mining Bureau should have been referable to such a representative organization; so also the standardization of terms used by engineers, as well as professional practices generally. We can best ascertain what scope there is for a new society by reviewing the work already being done by the three leading organizations, namely, the American Institute, the Institution in London, and the American Mining Congress.

The Institution of Mining & Metallurgy, in England, is performing a function which is more nearly the aim of the new association than any other mining society now existing. Founded in 1892, the Institution has always aimed to maintain a select membership, and while at first this took the form of a coterie, it has been successful, on the whole, in

restricting election to men of honorable record. This feature was discussed in these columns recently, so that we need only say further that the by-laws provide for candidates being of a specified age and experience, and in good standing professionally. In this way membership has been rendered as select as practicable and a fairly good standard has been maintained. The council is large and representative in a broad Anglo-American way; the presidency is deemed a high honor. In many matters of public interest, the Institution, by its council or by special committees, has taken part in shaping professional customs, in standardizing terms, and in moulding current thought concerning technical education. The pamphlets and the bound volume of its proceedings, as published annually, have enriched technical literature, and there is evidence of steady improvement in the quality of the writings. Undoubtedly the Institution, in the phrase of the period, "has made good." In the first clause of the constitution it is stated that: "The Institution of Mining & Metallurgy is established for the general advancement of mining and metallurgical science." That purpose is in course of honorable fulfillment.

But we have a similar organization in America and, when all is said, was not the Institution in London modeled on that of the American Institute of Mining Engineers? Certainly. The American Institute was the first to demonstrate the great usefulness of such an organization and in the quality (as well as the quantity) of its published transactions it has held the premier position for over 35 years. But the American Institute is a publishing institution only; as an organization it has been so generous in membership as to include not only professional men but "persons practically engaged in mining, metallurgy, or metallurgical engineering." Thus mine-owners and foremen, of no technical education and with no professional ties, have been elected; membership has come to mean chiefly a willingness to pay 10 dollars per annum for pamphlets and a volume of well-edited technical writings. By Rule No. 1, adopted at Wilkesbarre on May 16, 1871, it was stated: "The objects of the American Institute of Mining Engineers are to enable its members * * * to meet together * * * for the purpose of reading papers upon and discussing subjects which have for their aim the economical production of the useful minerals and metals, and the safety and welfare of those employed in these industries." In 1873, and again in 1875 and 1877, the rules were amended, and a wider scope is indicated by a change in the first rule, which now reads: "The objects of the Institute are to promote the arts and sciences connected with the economical production of the useful minerals and metals, and the welfare of those employed in these industries, by means of meetings for social intercourse, and the reading and discussion of professional papers, and to circulate, by means of publications among its members and associates, the information thus obtained." The definition of eligibility to membership remains today as it was in 1871. By Section 2 of Article X, in the constitution as adopted on February 21, 1905, it is expressly stated: "Neither the Council nor the Institute shall officially approve or disapprove any technical or scientific opinion or any proposed enterprise, outside of the management of the meetings, discussions and publications of the Institute, and the conduct of its business affairs by the Board of Directors." By Section 3, it is provided that: "Special Committees may from time to time be appointed by the Council to make investigations and prepare reports for presentation to the Institute, but no action shall be taken binding the Institute for or against the conclusions embodied in any such reports." The committees for which provision is thus made have not as yet been appointed, nor are they likely to be, for the whole policy of the Institute and that of its Secretary has been to avoid committing the Institute to any expression of opinion on matters outside of its own particular affairs. Nondescript membership is not favorable to joint action on public matters, heterogeneous character prevents any real solidarity, and thus the Institute, under the leadership and strong individuality of its talented Secretary, has become a great publishing institution that yearly adds a splendid volume to the reference library of the profession. As an engineering society it is a failure. There are reasons for this, other than the by-laws just discussed: the Institute has 4250 members and associates; the Institution has 1500. Of the Institute's members, there are about 450 living in New York and in the adjacent cities, that is, about 10% of the members use New York as a place of daily business. Of the Institution's members and associates, 450, or not less than 30%, reside in London and its suburbs. This has led to the holding of monthly meetings, at which the attendance is large; moreover, a large proportion of the members foregather at an annual dinner, besides other opportunities of organized fellowship. The Institute depends upon a scattered membership, distributed over an entire continent. Meetings are held annually or semi-annually; they are attended by from 1 to 5% of the members; the attendance, while representative in character, is much too small to emphasize the social side of the organization. The discussions are not nearly as general as in London, where twenty or thirty men will take part at a single monthly meeting; in New York the ventilation of ideas is carried on mainly by means of essays fired at long range, and while these often have a value greater than the impromptu speaking of our English friends, they lack the spontaneity and directness of an open debate. These comparisons and criticisms simply emphasize the fact that the Institute has developed a definite character and policy, the result of its constitution and habitat. It is too late in the day to expect any change. Certain work that it might have done, it has chosen to set aside; the work it has elected to do, it has done astonishingly well. Any new organization should strive as much to do what the Institute has left undone as avoid trying to perform the duties the Institute performs so well.

Next week we shall discuss the work of the Mining Congress, as a representative organization, and thus we can come to an intelligent idea as to whether there is need for a new association of mining engineers and metallurgists.

Personal.

C. W. Purington is at Vienna.

M. P. Boss has gone to Salt Lake City.

E. L. Dufourcq has returned to New York.

Curtis H. Lindley is at Washington, D. C.

Nathan T. Mansfield has gone to Rawhide.

George A. Schroter was in Sonora last week.

John E. McManus, of Seattle, is at Rawhide, Nevada.

Alfred von der Ropp is at Tour-de-Peilz, Switzerland.

Thos. R. Barbour is expected in San Francisco next week.

H. W. Hardinge has returned to New York from Cobalt, Ontario.

Courtenay De Kalb has been examining mines at Searchlight, Nevada.

H. G. V. Adler has returned to London from a visit to Cobalt, Ontario.

T. J. Hoover is expected here, on his way to London, from Australia.

Louis S. Noble has been examining mines in western Chihauhua, Mexico.

Robert H. Richards is making a short professional trip to Pennsylvania.

H. De C. Richards is examining a mine in Siskiyou county, California.

Oscar H. Hershey has been seriously ill and is convalescing at Los Gatos, California.

Zebina Lane, of Perth, Western Australia, arrived on the *Aorangi* and is now in San Francisco.

Ernest A. Haggott has been appointed manager for the Big Stick Gold Mining Co., in Arizona.

R. V. Norris, of New York and Wilkesbarre, is here in connection with the Monterey coal enterprise.

W. A. Carlyle has returned to London, having completed his inspection of the Le Roi mine, at Rossland, B. C.

Grant E. Davis, formerly at Manhattan, Nevada, and W. P. Cain have opened a mining engineer's office at Rawhide.

Percy Williams is at Vancouver, B. C., on his way to the Fraser river, where he is directing the operations of a gold dredge.

Henry Adams, of New London, Conn., is here as consulting engineer to the Brush Creek hydraulic mines, in Plumas county.

Charles A. Gehrmann, former manager of the Stanley mine, Idaho Springs, Colorado, is president of the Bank of Rawhide, Nevada.

Geo. W. Lloyd, E. F. Yates, and N. J. Churchill are asociated together in mining engineering work, and have opened an office at Rawhide, Nevada.

John Hays Hammond has recovered sufficiently to be able to return from San Francisco to Santa Barbara. His convalescence is progressing most satisfactorily.

T. H. Oxnam has returned from a trip of inspection of the Desert King mines, in San Bernardino county, Cal., and is now on his way to examine the Palmarejo and Guerra al Tirano mines, at Chinipas, Chihuahua, Mexico.

L. S. Austin has returned to the Michigan College of Mines at Houghton, from Milwaukee, where he had been called to give expert testimony in a suit against the Nibiack Copper Co., of Alaska, involving the treatment of the ore which that company is mining.

S. F. Emmons was the guest of honor at a dinner given at the Columbia University Club, New York, on February 26. The occasion was a demonstration, by graduates of the Columbia School of Mines, of appreciation to the distinguished geologist and his labors as a scientific man. James F. Kemp presided. Those present included John A. Church, Benj. B. Lawrence, J. H. Banks, J. Parke Channing, Robert Peele, A. L. Walker, Arthur S. Dwight, Joseph Struthers, F. M. Simonds, C. P. Berkey, E. C. Holden, A. C. Beatty, J. D. Irving, O. B. Perry, E. N. Skinner.

Latest Market Reports.

LOCAL METAL PRICES—Mar. 12.

Antimony	12@16c	Quicksilver (flask)	$45@45.50
Casting Copper	16@17c	Spelter	6½@ 7¼c
Pig Lead	4.10@ 5.05c	Tin	31½@33c

ANGLO-AMERICAN SHARES.

Cabled from London.

	Mar. 5. £. s. d.	Mar. 12. £. s. d.
Camp Bird	0 13 0	0 13 0
El Oro	1 1 10½	1 1 10½
Esperanza	1 3 1½	1 1 3
Dolores	1 2 6	1 2 6
Oroville Dredging	0 11 0	0 11 3
Stratton's Independence	0 2 6	0 2 6
Tomboy	1 8 9	1 8 9

(By courtesy of W. P. Bonbright & Co., 24 Broad St., New York.)

MINING STOCK QUOTATIONS—NEW YORK.

	Closing prices. Mar. 5.	Mar. 12.
Bingham Central	⅜	⅜
Boston Copper	14¼	14⅞
Cumberland Ely	7⅞	8
El Rayo	1½	1½
Giroux Con.	3¼	3⅛
Guanajuato Con	2	2
Nevada Con	9⅛	10¾
Nipissing	6¾	6¾
Tennessee Copper	28¼	28½
United Alaska	1¼	1¼
United Copper	5½	4⅜
Utah Copper	25	26

(By courtesy of Hayden, Stone & Co., 25 Broad St., New York.)

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date	Electrolytic Copper	Lead	Spelter	Silver
Mar. 6	12.25	3.67	4.67	55⅜
" 7	12.25	3.67	4.67	55½
" 8	Sunday.	No market.		
" 9	12.31	3.67	4.62	55⅜
" 10	12.37	3.67	4.62	55¼
" 11	12.37	3.67	4.62	55⅜
" 12	12.43	3.67	4.62	55⅛

SOUTHERN NEVADA STOCKS.

San Francisco, Mar. 12

Atlanta	$ 27	Laguna	1.00
Belmont	1.25	Manhattan Con	16
Columbia Mtn.	21	Midway	62
Combination Fraction	76	Mizpah Extension	05
Daisy	1.22½	Mohawk	
Fairview Eagle	50	Montana Tonopah	1.50
Florence	4.17½	Nevada Hills	3.00
Gold Bar (Bullfrog)	20	Red Top	
Goldfield Con	5.15	Sandstorm	27
Goldfield of Nevada		Silver Pick	25
Gold Kewanas	45	St. Ives	37
Great Bend	43	Tonopah Extension	95
Jim Butler	30	Tonopah of Nevada	5.62½
Jumbo		Tramp Con	18
Jumbo Extension	41	West End	23

(By courtesy of W. C. Ralston, 353 Bush St.)

COPPER SHARES—BOSTON.

	Closing prices. Mar. 12.		Closing prices. Mar. 12.
Adventure	1¼	Michigan	10
Ahmeek	50	Mohawk	49
Allouez	26½	Nevada Con	10¾
Amalgamated	54¼	North Butte	52¼
Areadian	3¼	Old Dominion	37
Atlantic	10¼	Osceola	83
Bingham Con	62½	Parrot	17½
Boston Con	15	Phœnix	50
Butte Coalition		Quincy	
Calumet & Arizona	101½	Rhode Island	3¼
Calumet & Hecla	605	Santa Fe	1⅞
Centennial	23½	Shannon	11
Con. Mercur		Superior & Pittsburg	12¼
Copper Range	62½	Tamarack	65
Daly-West	8⅜	Trinity	14¼
Franklin	8	United Copper com	47⅜
Granby	81	Utah Copper	
Greene-Cananea, ctf	8⅛	Victoria	3½
Isle Royale		Winona	5½
Mass	2¼	Wolverine	125

General Mining News.

CALIFORNIA.

EL DORADO COUNTY.

The Woodside-Eureka Co. is planning to replace the hoisting and pumping machinery on the old Eureka shaft and the re-opening of the old Eureka workings.——At the Magnolia mine the large pit bottom is being sluiced and the bedrock cleaned up.——At the Jones Hill mine, new sluices are being put in place and active preparations are being made for the immediate resumption of drifting. H. Ward is superintendent.——A new pump is being installed at the new shaft of the Little Chief mine, and sinking will be resumed next week.——The Fowlar Co. is taking out rich ore from a vein near the Delwisch mine.——At the Blue Rock mine work in the shaft has been temporarily suspended and the water is being used for sluicing in the pit, which has been successfully worked for many years. ——At the Collins-Bacchi mine work will be commenced on a new shaft about the beginning of April.——The Clipper mine has been recently purchased by W. A. Salisbury and the shaft will be sunk to 500 ft. as soon as the necessary machinery can be erected.

NEVADA COUNTY.

(Special Correspondence).—The Deadman's Flat district is rapidly becoming one of the busiest points in the county. Exploration and development work is going on at several properties, with good results.——At the Kenosha the shaft is still going down in good ore. Much development work is under way in the 300-ft. level, where excellent ore is exposed. The main orebody is showing well.——At the Normandie several men are sinking the shaft to exploit ore exposed near the surface workings. Promising indications are obtained as work progresses.——Some work is going on at the California, where good ore has been developed. ——Extensive developments are progressing in the lower levels of the Central shaft. The orebody in the new workings is of excellent grade.——The boilers, compressors, steam pumps, and the rest of the plant at the Banner mine has been purchased by George Bros. of Grass Valley.——An Eastern mining company has bonded 160 acres of land from local people. The price is said to be $50,000. The holdings contain a 40-ft. lode of gold, copper, and lead ore. The land is near the Mason ranch, 13 miles below this city. The bonders are endeavoring to secure additional land adjoining that recently secured. San Francisco people own much of the desired territory, and a representative will be sent to that city to interview the owners and make an offer.——The Leduc G. M. Co. has been organized by San Francisco and local people to work mineral holdings on the Leduc ranch. A tunnel will be driven to tap the gravel channel and quartz vein which were worked to a shallow depth several years ago. A compressor and 35-hp. engine will be installed. B. A. Penhall is general manager. ——Work is progressing steadily at the Midas mine. The ore-shoot has not yet been struck, but there are good indications of its near proximity.——The adit at the Fairview mine is being driven steadily. Considerable milling ore has been blocked out. It is the intention to erect a 20-stamp mill during the summer. C. M. Wilson is manager. ——Work will shortly commence on a new prospect shaft at the Spring Hill property. The ore exposed in the adit has encouraged the owner, C. K. Lakenan, to proceed with active development.——Good ore continues to come from the Home workings. The large body of low-grade ore in the Champion is also showing well.——A large force of men is working at the Mountaineer mine. Good ore has been encountered at several points.——The heavy fall of snow last week insures a plentiful supply of water for mining purposes during the coming season.

Grass Valley, March 9.

SAN DIEGO COUNTY.

A discovery of gold ore is reported near Dulzura, about 2½ miles southeast of the town. It is in a mountainous district and about a mile beyond the end of the road. The ore is free milling but of low grade.

SHASTA COUNTY.

The case of the U. S. Government *v.* the Mountain Copper Co. has been dismissed in favor of the latter. The case is the result of an action which has been carried up to the Supreme Court at Washington on account of the damage done to timber near the smelter by smoke. The appeal has been withdrawn and the Mountain Copper Co. has agreed to pay for the damage done to the Government forest lands. This is a test case, on which the future of other copper smelters in the district depended for a favorable decision.

SIERRA COUNTY.

Development work is being carried on at the Fairview mine above Relief hill, under C. W. Wilson's management. ——L. P. Woodbury is considering the purchase of the Tightner mine with a view to making a consolidation of several properties adjoining.

TUOLUMNE COUNTY.

Work will be resumed at the Melones mine immediately. Arrangements have been made between the company's officials and the miners' union and the strike has been declared off. The underground shift will be 8 hr., with 30 min. for lunch, and 8 hr. in the mill with 1 hr. for lunch. It is expected that 65 or 70 men will be employed within 10 days.

IDAHO.

IDAHO COUNTY.

(Special Correspondence).—Patrick J. Jennings of Portland, Ore., has completed the purchase of the Fifteen-Two and the Mountain Con. groups of claims in the Elk City district. This deal has been pending for several months, and was concluded by a cash payment in full for the properties. John Massam, of Spokane, is associated with P. J. Jennings. The Fifteen-Two consists of two claims having a vein of gold-bearing quartz from 12 to 35 ft. wide. The other comprises five claims on a quartz dike which stands about 18 ft. above the surrounding country and extends for over a mile in this manner. Development work is to be commenced early in the spring on the Fifteen-Two by driving a long adit to secure a depth of 400 ft., and on the other by means of two adits driven in opposite directions from the creek-bottom, which cuts the vein in two. Roads must be constructed and a plant is to be installed this summer. A 10-stamp mill will be erected, with provision for increasing to a 40-stamp capacity as development makes this necessary. Water-power has been secured, it is stated, which is capable of developing sufficient electric power to run all machinery at both mines, the longest power line being about eight miles.

Elk City, March 6.

SHOSHONE COUNTY.

(Special Correspondence).—The Nipsic Mining Co. Ltd. has been incorporated in Spokane, to operate a group of six claims lying west of the Hercules, near Burke, Idaho, the chief of which is the Father Lode, upon which a great deal of development has been done. The company is composed of prominent mining and financial men of Spokane. This property shipped several hundred tons of ore a few years ago which averaged $66 per ton, and it is now estimated that $118,000 worth of ore is already blocked out in the three adits above No. 4. This does not include two rich but small shoots of ore which have been stoped in No. 1 and 2, but which were left to one side of No. 3. A third large ore-shoot, principally concentrating, has been opened in No. 3 adit, where a drift has been run. The same shoot has been tapped in both tunnels above. No. 4 adit, situated 167 ft. below No. 3, is now into the hill 450 ft. and has also reached an ore-shoot. It is the intention of the company to continue this adit until it strikes ore several hundred feet ahead, which is believed, from surface indications, to be of larger extent than any yet opened. A small crew of men which has been at work some time is now to be increased and development work extended.——The first complete month's run of the Rex mill at Wallace was com-

pleted Feb. 29, and nine cars of concentrate and one of crude ore were produced and sent to the East Helena smelter. This is the first car of crude ore ever shipped, although the mine was a large producer several years ago. The ore produces concentrates running 60% lead and about 5 or 6% zinc. Ore removed in drifting at the foot of the winze carried 10% lead for the entire distance of 250 ft. No stoping has as yet been found necessary to keep the concentrator running three shifts a day. It is treating 190 tons per day, and would have a capacity of 60 tons more if water could be obtained in sufficient quantity. This produces 25 tons of concentrate daily. The drift at the foot of the winze is being carried westward as rapidly as possible, and is now within 24 ft. of an ore-shoot which is well defined in the tunnel above. When this is reached a considerable quantity of shipping ore will be available.——Several business men of Spokane, Wash., have recently become interested with J. Francis in the lease and option on the Rex. As soon as the new hoist has been installed at the winze, arrangements for which have already been made, sinking to a depth of 286 ft. will commence. The present hoist will be used for lifting timbers elsewhere in the mine.

Tool-Car at the Central North Star Shaft, Grass Valley, Cal.

Wallace, March 8.

The Gold Buffalo Mining Co. owns six claims near Buffalo Hump Mtn., including the Wise Boy. During last summer's run it was learned that most of the gold went out with the slime, and a cyanide plant is to be installed to obviate this loss. Improvements at the mine consist of steam and electric machinery, buildings, and an aerial tram 960 ft. long connecting the No. 2 tunnel with the mill.——Development consists of two adits, the first 110 ft. long, with a drift in ore 250 ft. long, and the lower adit, 387 ft. long with a 700-ft. drift. These tunnels are connected by an upraise 180 ft. high, which contains a manway and ore-chute. It is now proposed to drive a lower tunnel directly from the mill, thus securing greater depth, and also giving cover for work during the winter, as the heavy snows make difficult and expensive the operation of the high tramway.——The Charles Dickens has made another discovery of concentrating galena in its No. 2 adit at a point 100 ft. beyond where stoping is now in progress. The Dickens No. 2 adit is on the vein its entire distance, or practically so, and the ore struck at this time was reached by a cross-cut but 4 ft. long. The cross-cut being driven 9 ft. into the ore, has not yet given any indication of the other wall. This is thought to be an entirely different ore-shoot from the one now being worked. The Dickens has but recently been developed to the producing stage, and had shipped but a small amount of ore when the concentrator burned down. The concentrator is now being rapidly rebuilt on a larger scale, and it is stated by an official of the company that the mill will be running by April.——The Evolution mine, which closed last December, is to be reopened within a short time. F. R. Crocker is superintendent. The Evolution is one of the oldest locations in the Cœur d'Alene, and is favorably situated for economical development, with water capable of generating 350 hp. close at hand, through a flume controlled by the company, and the O. R. & N. but a short distance from the shaft. Development at present consists of an adit several hundred feet into the hill, which has shown good bodies of galena, and a main working shaft 300 ft. deep, situated some distance below the adit, from which several cross-cuts have been driven. Galena of concentrating and shipping grade has been shown in these cross-cuts. It is stated that machinery has now been ordered, and that the mine will be put on a shipping basis as fast as men and money can do it. The water-power will be developed within the near future.

MISSOURI.

JASPER COUNTY.

(Special Correspondence).—The rejuvenation of the Tanyard, Jackson, and Gordon Hollow camps, west and southwest of Joplin, has been the greatest development of the last two months. In 1898 and 1899 these camps furnished the major portion of the camp's production, but during the drop in prices and the working out of the rich shallow levels these camps were deserted. The ores were mined only to a depth of 90 ft., where the shafts entered a heavy stratum of flint, which the miners thought to be bedrock. A strange occurrence was the fact that the ores were found from the very surface to the 90-ft. level. The finding of rich deposits of ore at lower levels in other portions of the field induced a company of prospectors headed by Col. H. H. Gregg to return to this old camp and prospect the ground at a lower level. The work was successfully accomplished by sinking one of the older shafts through the flint beds, and at a depth of 150 ft. a second run of zinc-blende was encountered. A mill has been erected, and the owners of the land are receiving a royalty of $1000 per month on what was considered to be barren ground. This was the first work, and it was followed by a rush of prospectors to take up old abandoned shafts and leases. The Emperor Lead & Zinc Co. entered an old shaft and, sinking it to the 150-ft. level, discovered a similar run of ore. This company also erected a new concentrating plant and the ore-body was found to mill 6% zinc-blende.——Across in Gordon Hollow the resumption of operations has been no less marked. Among the best strikes, and one of the first to attract a new lot of prospectors to the camp, was that made on the old Daisy D. lease. A drill was put to work in one of the old shafts, and penetrated four runs of ore running from 5 to 40 ft. in thickness. The shaft was then sunk deeper and the new levels developed. The company is now erecting a concentrating plant.——On an adjoining lease the Monitor Mining Co. has reopened the old Monitor mine and has developed a workable face of sheet ore. Two other shafts on the same ground are now re-opened and concentrating plants will be erected. In addition to these strikes of ore and erection of new plants, there are large numbers of prospectors just now entering the camp, who are sinking the old shafts deeper or drilling contiguous ground. The development work in progress will add a large quantity of concentrate to the output of the Joplin camp during the early spring months.——Following the strikes made by Col. H. H. Gregg, the Matthes Bros. secured the old John Jackson Investment Co. tract of land lying up on the prairie at the head of the old Jackson, Gordon, and Tanyard Hollow camps. The tract contains over 600 acres. Drills were put to work on the land, and to date there have been 24 discoveries of ore lying in a sheet-ground formation. The drills have only just begun, and will continue the work during the spring and summer. The ores all lie at a greater depth than was supposed in that camp, but the shafts now sunk at Jackson station show up a good body of milling

sheet ore. The Matthes Bros. have re-opened the old Arkansas mine, just on the edge of the prairie where it breaks into the hollows, and are now milling ore from this old producer which had been deserted for years.——North of the John Jackson land at Cave Springs the Herald Mining Co. has extended the limits of that camp by developing a new lease of sheet ground. Fifteen drill-holes were put down and two shafts have been sunk. Three runs of ore were discovered, the first at 107 ft., with a 25-ft. face; the second at 155 ft., with a 30-ft. face; and a third at 220 ft., with a 42-ft. face. The ore carries 4% of zinc-blende with a smaller quantity of galena. A concentrating plant has been placed upon the lease and will handle 250 tons daily. The company holds a 30-acre lease.——J. J. Pullen has developed a lease at Central City and has just completed a new mill. The mill replaces the one recently destroyed by fire. The underground work has resulted in the exposure of a 20-ft. face of high-grade ore. The driving has progressed sufficiently to supply the mill only half time.

Joplin, March 6.

NEWTON COUNTY.

(Special Correspondence).—Southwest of Granby on the Chase land a new area of sheet ground has been developed by Chase & Heaton. Twelve drill-holes were put down on the tract and 11 of these penetrated ore from 12 to 20 ft. thick. The drilling was deep and the ore was only encountered below the 200-ft. level. The drilling was always continued to the 300-ft. level. A shaft was then sunk upon the most favorable strike and ore was encountered from 212 to 232 ft. The company then sunk seven drill-holes immediately surrounding this shaft, in order to explore the orebody. All of them penetrated the same ore-bed, thus demonstrating that the ore underlaid at least four acres. A small test-mill was erected at the shaft, which demonstrated that the ore carried about 4% galena and zinc-blende, with the proportion between them of one to three. A new 500-ton concentrating plant has been erected and equipped with electrical power. In the immediate vicinity the Granby Mining & Smelting Co., the Illinois Zinc Co., and the Empire Zinc Co. have been drilling land, and the results have shown a wide area of this sheet ground, embracing over 800 acres. The ore occurs at the same level, taking into account the topography of the region.——North of Granby, the Granby Mining & Smelting Co. has had two drills at work demonstrating the extent of a sheet-ore deposit recently discovered at a depth of 300 ft. The company is now sinking a shaft to develop the new orebody. This marks the first attempt to work a deep deposit of ore in the Granby area.——On the prairie southwest of the town J. Roden has developed a new run of blende ore at the 100-ft. level. The strike is near the old Mascot mine, one of the greatest blende producers in the camp. A concentrating plant has been erected.——In the eastern end of the camp operations have been carried to a lower level in the Lady Bird and Fortune Teller mines. These have been exceptionally heavy producers of zinc silicate in the upper levels. Recently the Lady Bird shaft was sunk to a second run of zinc silicate, much richer than any worked in that mine before. The Fortune Teller, adjoining, followed suit and opened a still richer body of ore. The company operating it has now erected a concentrating plant, the first one ever built in the east end of the camp.

Saginaw, March 7.

MONTANA.

MADISON COUNTY.

The Mayflower Extension Gold Mining Co. has been organized to develop the Hidden Treasure, Long Island, and Jubilee lode claims, adjoining the Mayflower mine, which was an important producer. The property was examined before purchase by A. V. Corey, and it is expected that a continuation of the Mayflower orebody may be found on this claim, which is within 250 ft. of the old Mayflower ore-shoot. There are two shafts on the Mayflower, one 200 ft. and the other 300 ft. in depth. Drifting will be immediately commenced on the 200-ft. level.

NEVADA.

ELKO COUNTY.

Operations will soon be commenced by the Tuscarora-Nevada Mines Co. A four-compartment shaft will be sunk and a power plant erected. The 40-stamp mill will be equipped with concentrators and later additional reduction works will be added.

Gold Circle is one of the new camps that have recently been formed in Nevada. It is in the extreme western part of Elko county, north of the Southern Pacific R. R. The camp has about 300 people, and assays from $30 to $80 have been obtained from ore in prospect shafts 30 ft. deep. The Bamberger claim was the first discovery, and rich ore is also reported from the Spotted Dog, an adjacent claim, on which a tunnel 70 ft. in length has been driven.——Satisfactory developments are reported from the property of the Delmas Copper Co. on their properties in Lee canyon. A tunnel is being driven to explore a granite and limestone contact on which lodes of copper ore occur. Already two veins have been cut by the tunnel, which is 170 ft. in length. The tunnel will be driven 200 ft. farther to cut a vein which shows a good outcrop on the surface.

ESMERALDA COUNTY.

The legal contest between the Mine Owners' Association and the Goldfield miners' union resulted in a decision in favor of the former, by which the miners, under penalty of contempt, involving fine or imprisonment, must refrain from interfering in any way with the business of the petitioners, from using intimidation in any way whatever, either by picketing, visiting the houses of miners supplanting the union miners, or making threats of any kind, or from holding meetings within the Goldfield mining district. The injunction applies to each individual officer who is named in the pleadings, and to the members of the Goldfield miners' union.——The output of Goldfield for February is valued at $218,730. The Combination mine and mill treated 2300 tons, valued at $92,000. The Western Ore Purchasing Co. received 556 tons, averaging $100 a ton, as follows: Mohawk-Combination, 72 tons; Florence Annex, 147 tons; Black Butte, 15 tons; Daisy, 58 tons; Diamond Queen, 11 tons; Great Western, 33 tons; various dumps, 220 tons. The Nevada-Goldfield Reduction Works treated 1119 tons, valued at $54,330.

The ore shipments over the Tonopah & Goldfield railroad for the week ending Feb. 5 consisted of 223 tons from the MacNamara, 102 tons from the Midway, and 47 tons from the Tonopah Extension. The Tonopah Co. sent 4740 tons, the Belmont Co. 820 tons, the Montana-Tonopah 1100 tons to the mills, making the total shipments for the week 7032 tons. The total output of the Tonopah mines was 7032 tons, of an estimated value (the shipping ore being valued at $60 per ton and the milling ore at $20 per ton) of $155,520.——Sixteen machine drills are in constant use on the Belmont. Little of the waste is hoisted to the surface, it being used to fill up the old stopes. Good progress is being made in the No. 12 south cross-cut, 450 ft. east of the shaft on the 700 level. It is now out about 230 ft., 26 ft. having been driven this week. On the 800 level, raise No. 1 on the south vein, west of the cross-cut, is being pushed to connect with the No. 12 cross-cut on the 700 level, a distance of about 50 ft. having already been made. This raise is all in ore of good milling grade, the vein showing an average width of 3½ ft. Driving east continues on this vein and the drift is now 130 ft. long. On the 1000 level driving continues east on the Mizpah vein, which was cut on No. 5 north cross-cut, a distance of 13 ft. being made last week. The vein is the full width of the drift, with quartz showing on both sides, but is low grade in quality. An advance of 33 ft. was made in the No. 3 south cross-cut last week. The drift on the sulphide vein which was cut in the No. 6 north cross-cut is now 28 ft. east and 18 ft. west, and the vein improves as work progresses.

LYON COUNTY.

(Special Correspondence).—Ramsey district, 15 miles northeast of Virginia City, has a system of veins on the contacts of andesite and diorite. There are said to be 12

parallel veins of this character, containing free-milling gold ore. On the group of the Ramsey-Comstock M. Co., managed by A. H. Wayne of Goldfield, is a 400-ft. shaft with drifts on four levels disclosing a vein 25 ft. wide.

Ramsey, Feb. 29.

NYE COUNTY.

Construction work at the Round Mountain Reduction Co.'s works is nearing completion. The machinery is all in place, and little remains to be done now except to lay the pipe which will carry the water from the pumping station into the Elspass. The plant will be running at full capacity within a week. Contracts have already been made with several lessees to treat their ores.——The February payroll of the Round Mountain Mining Co. was $7000.——The lower adit of the Round Mountain Monster Co. is 305 ft. long, and numerous tungsten stringers have been cut. ——The McLean-Perkins lease sunk a vertical shaft nearly 200 ft. on the Shot Fraction.——The Hydraulic Co. will soon have a new pipe-line completed, and the heavy snowfall ensures a good season.

A report on the Nevada-Wonder mine made by R. H. Sanders states that the ore blocked out amounts to 11,203 tons assaying over $20 a ton, and 6215 tons assaying below $20 per ton. The ore at the bottom of the 500-ft. shaft was found to be low grade, but the workings at this level are 100 ft. north of the nearest known high-grade ore, and it is expected that this shoot will be found by driving south. There are 2000 tons of ore on the dump assaying $36 per ton.

A discovery of rich ore has been made about seven miles from Rogers in the Toyabe mountains, across the Big Smoky valley from Round Mtn.. The ore was found in the Buckeye mine in a 16-ft. raise, where an 18-in. streak of fine-grained galena with native silver was found. Owing to the deep snow it is difficult to get into the district.

STOREY COUNTY.

Interest in the new find in the West Comstock district is increasing. A number of people have visited the discovery, which has some promise of consistency. Wood and water are plentiful and the mining conditions are excellent.

WHITE PINE COUNTY.

At the Veteran mine of the Cumberland Ely the preparations for making regular shipments are nearly completed. The shaft is down 350 ft. and will be sunk to 400 ft. This work was started on Sept. 25 and has been continued at an average rate of 30 ft. a week.——At the Giroux mine the work of recovering the shaft is going on slowly. The working force has not yet reached dangerous ground, being still above the cave. Another run of ground occurred in the mine during the week, and this was from the old cave, which shows that the ground has not yet settled. It is hoped that the shaft may be saved, but it will probably involve great expense.

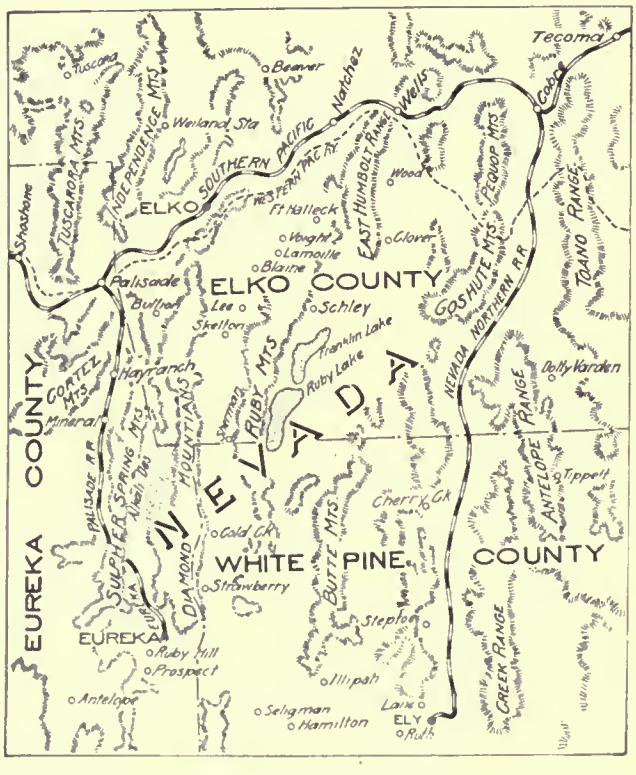
While doing assessment work on the Vesta mine to secure a patent a shaft was sunk 40 ft. This is said to have encountered the productive monzonite formation, and 4 ft. of sulphide ore containing chalcopyrite has been discovered. The shaft was sunk in a porphyry intrusion in limestone in a part of the Robinson district in which no ore has been found previously, and consequently the discovery is considered important. The Vesta mine adjoins the property of the Ely Northern Copper Co., and it is hoped that the productive area will prove to be greater than it has been generally considered.

Construction work at Ely is progressing well, and the concentrator and smelter of the Nevada Con. should be ready for operation by the beginning of May. By the middle of April the tracks of the Western Pacific will be opened for traffic between Ely and Salt Lake City.

NEW MEXICO.

SOCORRO COUNTY.

(Special Correspondence).—The Enterprise Mining Co. in the Mogollon district has let a contract to drive its main adit to connect the mine and mill. Hitherto the ore and mine supplies had to be sent over a steep and difficult trail which in bad weather was almost impassable.——Peterson & McGuire have bonded their Dry Creek property to J. Whiteside. The first payment has been made, and the new owners have advertised for bids to sink the shaft 100 ft. This property differs from most of the mines in Mogollon in occasionally producing high-grade telluride ore.——E. Craig, president of the Mogollon Motor Road Co., is again in the district and reports conditions of the road progressing smoothly. The company has purchased and tested its cars, which make the run between Silver City and Mogollon, a distance of 90 miles, in six hours. In wet weather the cars experienced some difficulty in making schedule time, as they were compelled to run over the same road used by the heavy freight teams. To do away with this delay, the company applied for a Government



Map of Eastern Nevada.

right-of-way, and has machine graders with which to construct the new road.

Mogollon, March 6.

OREGON.

BAKER COUNTY.

The discovery of ore recently made in the Greenhorn mountains was on the property of J. W. Fleegle and W. Clark, who have been developing it for several years. The vein at the surrface is from 15 to 20 ft. wide, and this has rcently been reached in a cross-cut adit. The ore is of good milling grade. The Psyche, joining it on one side, and the Snow Creek on the other, have both produced ore of high grade.——T. S. Kennerly is superintendent for the Highland Gold Mines Co. A cross-cut is being driven to cut the vein, but it will be several months before the objective is reached.——A low-level adit driven on the Wolverine mine by W. H. Robinson has cut the vein, which is 12 ft. wide. The ore has not yet been assayed.

WASHINGTON.

FERRY COUNTY.

(Special Correspondence).—The Copper Key Mining Co. has decided to install a larger air-compressor, and the manager, E. L. Tate, accompanied by an engineer, is at the mine making investigations.——A group of 14 claims has been located on Hall creek, west of the Columbia river, on the South Half of the Colville reservation. On the group a wide vein has been traced two miles. The ore contains lead and silver carbonates, the lead assaying from 10 to 75%. A

contract has been made for a sale of the group for $30,000, full payment to be made on or before May 1.——The Republic mine, which formerly paid $600,000 in dividends, but was sold for taxes in 1906 and bought in by the county, was today leased by the county to Richard Mulroy for two years, the lessee having an option to purchase the mine for $40,000. A royalty of 10% to be paid under the lease will apply to the purchase price. The lessee must begin work within 30 days and continue it to the expiration of the lease, unless he purchases the property before that date. W. J. Casey, Wm. Peirce, and Chas. P. Bennett, attorney of Ferry county, are understood to be associated with Mr. Mulroy. The mine is in such condition that it will require at least a month to put it in working order. The upper levels will be developed with drifts and cross-cuts before any attempt is made to operate below the 600-ft. adit level. ——Wm. M. Crummer, lessee of the Insurgent mine, has been appointed superintendent of the Pearl Con. property under the option held by the Syndicated Deep Mines Co.—— The Lone Pine workings have been unwatered to a depth of 95 ft.——The Insurgent mine continues a paying venture for the lessee, the pay-shoot continuing to yield good ore. ——Work has been resumed on the Pin Money adit by the Oversight Mining & Milling Co.——The Summit Gold & Copper Mining Co. has completed additional living quarters and will increase its force on the Railroad mine, two miles south of Laurier. Besides a large deposit of low-grade ore with an excess of iron, a streak 3 ft. wide has been encountered which assays $45 per ton in gold and copper. There is 30 ft. of ore now in sight, and the company will soon start shipping. P. O'Brien of Laurier is superintendent.

Republic, March 4.

STEVENS COUNTY.

(Special Correspondence).—The Robena Silver-Lead Mining Co., which is developing four claims that had lain idle for a number of years, reports it has recently found some good galena in the abandoned workings. Assays show an average of $40 per ton. A large quantity of ore has already been placed in bins, ready for shipment. The erection of a small concentrator is now under consideration.

Spokane, March 7.

(Special Correspondence).—The Robena Silver Mining Co. has four claims 1½ miles northeast of Bossburg. Considerable ore has been developed and shipments have been made. A concentrator is to be installed. About 7000 tons of silver-lead ore, having an average value of $21 per ton, have been blocked out. The largest body yet developed is opened by an adit 380 ft. in length. Four carloads of ore were recently shipped to the smelter. C. W. O'Connell is the manager. William R. White is president, and I. D. Nickerson secretary. The principal place of business is Spokane.——The Columbia Tungsten Co. has ten claims near Springdale, covering two distinct veins of tungsten ore. One vein is crossed near the surface by a short adit. Four men are now driving a lower adit to cross-cut the second vein. A 30-ton concentrator is projected, to be installed as soon as the money is subscribed for the purpose. ——The Cedar Canyon Smelting & Reduction Co., owning five tungsten claims, is planning for a 50-ton concentrator, to be built at the mouth of Cedar canyon for its own and custom ores.——Deer Trail camp is reported to be looking particularly bright, and over 100 men are employed, many of them being engaged in developing tungsten properties, in which the Krupp Steel Works of Essen, Germany, are reported to be interested.——The Valley Dew Mining Co. has been incorporated to work the Shiflett, Young, and Hodnett claims, north of the First Thought group.——Work is progressing on the No. 3 adit of the Trojan mine. The company will construct a wagon-road to the mine and build additional living quarters for the men as soon as the snow disappears. The mine looks well, and the company expects to be shipping soon after the middle of the year.——Work has been started on the Little Kitten group by the Mohawk Mining Co., a new organization.——The Krug Gold Mining Co. is about to drive an adit 320 ft. to cut a 4-ft. vein 217 ft. deep, and will install a 3-drill compressor plant and dynamo for lighting the mine and company buildings. The ore is said to assay about $40 per ton in gold, silver, and copper. The mine is situated north of Chewelah.—— A small force is cleaning up and getting ready to renew operations on the Walter Scott mining claim, near Northport. The vein is opened by shafts, open cuts, and a 500-ft. adit. A contract has been let for a year's work by a larger force of men, which is expected to put the mine on a paying basis.

Republic, March 6.

CANADA.

BRITISH COLUMBIA.

(Special Correspondence).—The smelter of the Sullivan Group Mining Co. at this place has been closed indefinitely. The cause is given by the management as the refractory character of the ores. It is well known that there has been an excess of zinc, which has greatly increased the treatment problem, and the company has been treating its own ores almost exclusively, using only a small tonnage from the First Thought mine. It is said the ores in the company's mines at Kimberly has been showing an increase in zinc as development continued, but this is not positively verified. The mines have also been closed. At the time A. I. Goodell took charge of the smelter last fall the company was thought to be in excellent condition and making considerable reductions in the cost of treating its ores, but this advantage has been offset by freezing of water, thus diminishing the power, and by the refractory quality of its ore. Rumors that the company had been forced to close for financial reasons, and that liens were to be filed on its property, are denied by the management.

Marysville, March 8.

The annual meeting of the stockholders of the British Columbia Copper Co. was held in New York recently. The year's operations were the most trying and hardest in the history of the company. In the winter of 1906-1907 the Northwest was subjected for many weeks to the most serious fuel famine ever known. When active operations were resumed, the price of copper fell so low that smelting operations were finally abandoned. In spite of this series of misfortunes, the condition of the company's affairs is perfectly satisfactory, and the ore-reserves have been increased during the last year, and the smelter is splendidly equipped. The result of the year's work shows an income of $88,155 and surplus of $176,041, and a new property, the Lone Star & Washington, has been purchased.——A new record was established at the Granby Con. smelter at Grand Forks, when 3450 tons of Phoenix ore was treated in 24 hr. in 8 furnaces.——Machinery worth $20,000 will be installed at the Bertha Con. Gold Mining Co. near Grand Forks.

The officials of the Tacoma smelter have acquired a large interest in the Eagle group of copper claims, adjoining the Japanese group near Jedway, Queen Charlotte Island. Arrangements will be made to build an aerial tramway to the beach and erect a compressor. The Eagle group, which was formerly owned by F. M. Newberry and his brother, is a property of great promise. There is a 40-ft. shaft and a 30-ft. adit, all in one. Several veins occur, one of which is 20 ft. wide. The ore is said to average 7% copper, 40 oz. silver, and $1.30 gold per ton.——The Sally mine has shipped three car-loads of ore since Jan. 1.——The January output for the Le Roi No. 2 was as follows: Josie mine shipped 2711 tons, valued at $68,592, and 142 tons of concentrate worth $2235. The Vancouver mine shipped 278 tons and received $16,298, and also $9804 for 1316 tons of zinc ore which had accumulated for several months.—— The output of the properties of the Con. Mining & Smelting Co. for the last six months has been published. The mines produced nearly a quarter of a million tons. The Centre Star group at Rossland, B. C., 87,451 tons; St. Eugene group, Moyie, B. C., 75,104 tons; the Snowshoe mine, Phoenix, B. C., 86,109 tons. The total production of the mines was about 1380 tons per day, and the amount smelted at Trail about 1116 tons per day, producing 42 tons of lead bullion worth $165 per ton, and 14.8 tons copper matte averaging $453 per ton.

Special Correspondence.

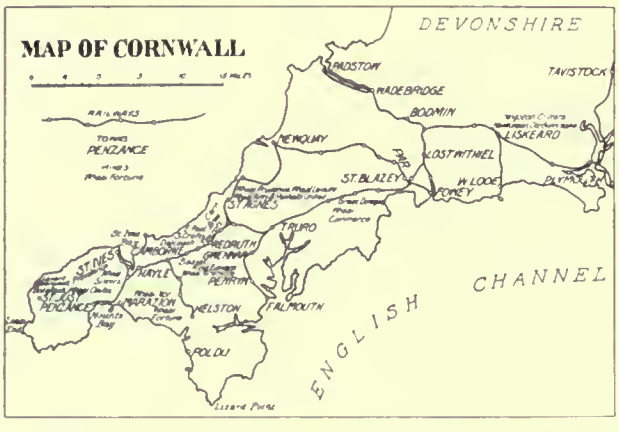
LONDON.

Mining Booms.—Cornish Mining.—Air-Cushioned Stamps.—The Chartered Company.—Reforms and Finances.

The various articles and letters in your pages relating to the 'Psychology of Mining Booms' have naturally been read with interest in this country. I should like to add a few remarks, which represent the views of many people on this side. In your issue of January 25 you printed a contribution by me, urging that the position and rank of the mining engineer should be gradually improved in such a way that his word would be taken as to the value of a mine, capitalization, and purchase price. As it is, the financiers have it all their own way in this matter, and money is extracted from the public by what are too often false pretences. Shareholders and intending shareholders are given an utterly wrong idea of mining operations. Financiers say that unless you stuff the people with all sorts of plausible stories about immediate profits, they will never subscribe for mining shares. As an example, the financiers say when inaugurating a company that a certain sum is ample and that the mine will pay within a year. Those who know the City, are perfectly aware that next year the chairman will begin his speech thus: "Owing to unexpected difficulties, etc., etc." I need not write the rest. Now to get back to my point. It seems obvious to me that while shareholders take the word of financiers and not engineers in matters of capitalization, purchase price, and general expenditure, so long will it be necessary to inaugurate booms for the purpose of raising capital. When mining operations are entirely controlled by mining engineers, booms will no longer be necessary and will die of atrophy.

The East Pool & Agar United Mines is perhaps the best managed mining company in Cornwall. It still operates on the cost-book system and pays for modern plant out of revenue, besides providing very decent dividends. The ore is troublesome stuff, containing tin, wolfram, copper, and arsenic, so that it is impossible to effect any preliminary sorting of the ore. The accounts of the company are made up every quarter. During the last quarter of 1907, a profit of over £2000 was made, and £1920 distributed in dividends. The profits were much smaller than during the earlier part of the year, owing to the drop in the price of tin. The total ore sent through the stamps was 16,007 tons, yielding 153½ tons of tin concentrate, which sold for £12,248. Arsenic brought an income of £4947, and wolfram £1252. The amount of copper in the ore is not at present very great, and is only reported every half-year. It is noteworthy that the substitution of old plant is still going on. At the present time, six new air-cushioned stamps are being erected to take the place of some of the old Cornish stamps. About a year ago two air-cushioned stamps were erected as an experiment, and the fact that six more are now being put up shows that their performance is satisfactory. These stamps are called by their makers (Holman Brothers) 'pneumatic stamps,' a name that leads many people to the idea that they are operated by compressed air. I have accordingly re-christened them air-cushioned stamps. They are operated from a crank-shaft through a connecting rod, which is connected to the stamp-stem by an air-cushioned joint. The stamp can work at a great rate and will crush twenty times as much rock as a California stamp. Naturally, such a machine requires a higher class of attendant than an ordinary stamp. It seems to me to be a machine that deserves more attention from mining engineers than it at the present receives. Another interesting point is that these new stamps are to be driven by steam-power and not by electricity. There is a large electric generating station close by which drives the Redruth & Camborne tramways, and supplies power to all sorts of industrial concerns, including the South Crofty mine. A close study of costs, however, has shown that for the new East Pool stamps the costs would be greater than if steam is used. The control and management at this mine is in the hands of Cornishmen, notably J. H. Collins, Joseph Tamblyn, and Amos Treloar.

Two weeks ago I referred to the meeting of shareholders held in London to discuss the present state of the British South Africa Co., and of the country under its control. The report of the company for the year ended March 31, 1907, together with the financial statement, have been issued this week, and the proposals of the directors for raising the necessary funds for effecting improvements in the country and its government have been submitted to shareholders. There is no doubt that the company has arrived at an important epoch in its history, and it is desirable that the present position shall be



seriously considered without political or racial prejudice. There are times in our lives when personal interest should be waived for the benefit of the community, and when the efforts of capable men should be supported. It is pretty clear that the continued inability of the directors and administrators to make ends meet should no longer be condemned by the public and by disappointed shareholders, but that our criticisms and suggestions should take the form of continually urging a relaxation of bureaucratic rule. The time is not far distant when Rhodesia will have to be made a public State and not a private property, and amalgamated into a consolidated South African State. It may be five years or more before this happens, and in the meantime, every effort should be made to democratize the government and the conditions under which the white man is governed. The proposition now before shareholders is the creation of 3,000,000 new shares of £1 each to be issued at par. One million are to be offered to shareholders at pro rata forthwith, and subscribers to the new shares will have the option of similarly subscribing for another million on or before March 31, 1910, and a third million up to March 31, 1912. At the present time the nominal capital of the company is £6,000,000, but as many of the shares were issued at substantial premiums, the actual sum subscribed comes to nearly ten million pounds. For instance, in 1895, 500,000 shares were subscribed for at £3 10s. per share. All issues of new shares since the original issue on the formation of the company have been made at some premium, until the issue now being made. Many share-

holders who bought their shares on the open market paid high prices, at one time the quotation being £8. At the present time the shares are quoted at about 15s., so that the motives which will urge shareholders to take up new shares at par will consist of a mixture of duty and self-preservation. It is not possible in the space at my disposal to go into the question of the many reforms contemplated by the Company. One of them, however, may be mentioned. This is the re-organization of the engineering department, whereby the services of Mr. A. H. Ackermann and his staff are placed at the disposal of companies and individuals wanting advice about ores and prospects. The fees charged will vary according to the means of the enquirers. The poor prospector will be charged a merely nominal fee, and a new assay-office is to be established at Bulawayo for this purpose.

Capt. W. R. Thomas, of Tywarnhaile, Cornwall, gave a lecture last week to the students of the Redruth School of Mines on 'Prejudice in Mining.' This was a lecture of a type that should be more often heard in the mining schools, where the personal element and methods of thought are usually passed over in favor of the dry details of every-day practice. It was a lecture that should have been listened to by grown-ups as well as youths. Prejudice in mining is as great a hindrance as indifference in the advancement and improvement of mining and metallurgical methods. In spite of the printing press, electric telegraph, and the railroad, we are apt to be as parochially minded as ever. A Cornishman who has never been out of his county is not receptive to ideas introduced from the outside. An American of local training has a poor opinion of the inventions or devices that come from England. Captain Thomas gave many interesting examples of Cornish prejudice, notably the case when the Cornish managers condemned the Frue vanner and Wilfley table without a hearing. We are all fond of pointing to the Cornishman as slow to move and slow to imbibe new ideas, but my experience has been that the American has just as many preconceived notions. Did not the Americans conclusively prove that the cyanide process was of no value? And how many untraveled American engineers have ever heard of tube-mills, the Merton furnace, or the Elmore vacuum-plant. I heard an eminent American metallurgist the other day condemn the vacuum process before he understood it, adding that the American method of treating ore was to get a profit out of it somehow, not worrying at all about how much was lost. Similarly, there is a popular opinion in America that American companies manage their mines better than English companies do, but any American who has traveled and taken the trouble to study the question knows that this opinion is only a prejudice. Again, in the matter of metallurgical practice, it is commonly supposed that American dressing and smelting is in advance of the rest of the world, but this common supposition is also only a prejudice. I am not writing these remarks just for the pleasure of saying nasty things about my American friends, but for the purpose of pressing home the lesson that prejudice in mining is to be found everywhere.

BUTTE, MONTANA.

Resumption of Work.—Enlargement of Great Falls Smelter. — Cost of Producing Copper. — East Butte. — Electrical Machinery for the North Butte Extension.

All of the properties of the Amalgamated Copper Co. are again in operation. The concentrator at the Washoe smelter at Anaconda was started a week after the mines opened, and the smelter itself is getting into operation again. Within two weeks, it is anticipated, work will be in full swing, producing copper at about the same rate as before the curtailment last September. The output of the Washoe smelter will be from 15,000,000 to 17,000,000 lb. copper per month; that of the plant at Great Falls will also be increased about one-third. A fourth section of the smelter was shut down during the curtailment, and that will be put in commission again shortly, which will mean an additional capacity of about 400 tons of ore daily, making the plant's total capacity 3600 tons. There are other improvements and enlargements under way at the Great Falls smelter that will, when completed, enlarge the capacity about 1000 tons per day, but these improvements will not be completed for a while.

The cost of producing copper in Butte has, during recent years, run from 9 to 12½ c. per lb., the average being about 11 c., this high cost being due to many causes, namely: Extensive permanent improvements and exploration work, charged up to cost of production; ineffieient labor, due to the independence of workmen during the boom days, with its mining litigation and political strife, which made it necessary to give employment to voters, regardless of their capabilities; increase in wages, and increase in the cost of supplies and railroad rates. Many of these causes have been removed. Wages have again been reduced to the normal standard, and miners are giving at least 25% better results than formerly; prospecting work has been stopped, and the permanent improvements have been completed. It is therefore the expectation that copper will be produced henceforth for some time at a cost not to exceed an average of 9 to 10 c. per pound.

The East Butte Co., its officers and lessees, who were recently sued for damages by the South Butte Co., which lays claim to some mineral nnderlying a Great Northern right-of-way that passes over a corner of East Butte ground, has made answer in court and admits the mining complained of, only disputing the value of the ore taken out. The lessees claim they mined it with the consent of the East Butte Co., and the latter says the mining was done under its direction. To emphasize its position, the East Butte Co. has brought an injunction suit against the South Butte Co., and demands an accounting for ore taken out of the same ground. The East Butte has also sued the South Butte for $100,000 damages because the South Butte miners dynamited an important cross-cut from the Adams shaft, into which it broke, while prospecting in East Butte ground. As regards the controversy between the Red Metal Co. and the East Butte lessees, a statement was made in court by an attorney for the Red Metal Co. that the latter had no controversy with the East Butte, and that the damage done by the lessees was nominal. The injunction asked for by the Red Metal Co. against the lessees will not be resisted, and no claim for damages will be pressed. There is the best of understanding between the Red Metal and the East Butte, and also between the latter and the Amalgamated. The engineers of the latter have access to the East Butte mines at any and all times. As the Washoe smelter at Anaconda will again receive custom ore, the East Butte will shortly resume mining.——John A. Ryan, superintendent of the North Butte Extension Co., has gone east to examine electrical machinery, with which the Extension mine will be equipped. The new plant will cost $50,000, and will be installed so that it can be used when the shaft reaches a depth of 1000 ft. The equipment will consist of a double-drum electric hoist, an electric air-compressor, and an electric pump, which will be placed at the 1000-ft. station. An electric pump will also be placed at the 700-ft. station, and will have a capacity to lift 760 gal. per min. The shaft is now down 600 feet.

MEXICO.

Resumption at Velardeña.—San Carlos Copper Co.—Progress in Chihuahua.—The Rosario Co.—Mexican Mines Syndicate.

Most encouraging is the report that comes from Velardeña, Durango, to the effect that, as a result of the recent visit of some of the head officials of the American Smelting & Refining Co. to the company's mines at that point, work will be resumed therein on a larger scale than for some time past. Of the company's properties at Velardeña, the Santa Maria is the only one in which any serious work has been done for the last four or five months, it having continued to yield approximately 12,000 tons per month, most of which, however, goes to the concentrating plant before being smelted. Now, however, work will be resumed at the Copper Queen and the Cobre Grande, and the Terueras will be pushed to its full capacity; and as a consequence the Velardeña smelter will be worked to its full capacity in both the lead and the copper departments. William Davey, superintendent of the mines, will be succeeded by C. H. McMahon, who was for some time in charge of the Sombrerete Mining Co., at Sombrerete, in Zacatecas, but who more recently has been in charge of the A. S. & R. Co.'s Santa Francisca mine at Tepezala, Aguascalientes. As against the good news from Velardeña, comes word that the San Carlos Copper Co., near Linares and just south of Monterrey, in the State of Neuvo Leon, has closed its smelter and San José mines, which Charles Self has kept running for many years, notwithstanding innumerable difficulties. Though this means the laying off of some 500 or 600 men, there has been at all times such a question as to its being a profitable proposition, that the shut-down will be viewed with small regret by mining and smelting men in general. On the properties of the Norias de Baja Mining Co., near Monclova, in Coahuila, considerable development work is going on, principally in the shape of four new shafts which are being sunk on different portions of the ground, and all of which are said to have good showings of lead ore, and for this work bonds for $100,000 are being sold, bearing 1% per month interest, payable quarterly. This company, notwithstanding its many litigations and considerable difficulty with zinc in the ores, has been a steady dividend-payer, and it is believed that the new work will be of direct benefit to its future success. Another property near Monclova, though at present closed because of the low price of copper, is preparing for extensive improvements; this is the Panuco of the Continental Copper Co., a subsidiary of, or closely allied to, the Jimulco, in Coahuila. At the Panuco are large bodies of copper and iron sulphides, running 4 to 5% copper, with a light soft gangue, and experiments have shown that the ore can be cheaply concentrated to 15 or 20% copper, and now S. D. Bridge, one of the directors of the company, states that orders have been placed for a 200-ton concentrator, and preparations are being made to push the construction by A. L. Tuttle, general superintendent for the Continental and the Jimulco companies.

In Chihuahua, the Rosario Mining & Smelting Co. has obtained a concession from the Government for a 30-ton smelter at Urique, in the western part of the State, together with the right to dam and use the water of the Urique river for power purposes for the next ten years. The Rio de Plata Mining Co., for which D. M. Shanks is general manager, has completed its 25-stamp mill, with Pelton wheel-power, in the Guazapares district, and is making regular shipments of concentrate to the El Paso plant of the American Smelting & Refining Co., while the tailing is being stored for treatment in the cyanide vats that are being constructed. The Buenas Aires Mining Co., of California, which is opening up the Lola mine in the Cusihuiriachic district under the direction of W. M. Ford, has also begun shipments of high-grade silicious ore to the A. S. & R. Co. The affairs of the Mexican Mines Syndicate, operating the La Reina and Buenas Aires mines, near Cusihuiriachic, and the Minillas, near Chihuahua, and which went under soon after the recent drop in silver, seem to be still in a muddled condition, but it appears that the Maderos, or in other words, the Torreon Metallurgical Co., being the largest creditors, will obtain control of the properties and either work them until their own claims are satisfied and then turn them over to the next largest creditor, or else work them for the general interest of all the creditors.

Part of Northwestern Mexico.

ROSSLAND, BRITISH COLUMBIA.

General Improvement.—Discovery in the Le Roi.—Shipments From Rossland.—The Boundary District.—Hours of Labor.

Things are brightening up a little at Rossland. A strike of ore running high in gold is reported from the Le Roi mine. The shoot was opened up on the 1650-ft. level, and the assays run from $17 to $40 per ton. This is encouraging, as heretofore the ore on the 1650-ft. level has been poor. The ore is of a pyritic character and where mixed with quartz carries gold, at the same time there is an excess of iron over silica. The Le Roi No. 2 has declared another dividend of two shillings. This company has paid $3.36 per share in dividends since October, 1905. The Blue Bird, Homestake, and Red Eagle properties in the South Belt have been leased and will be actively worked this spring. Three or four other properties in that district will be worked this summer.

While the profit on the Granby operations has almost touched the vanishing point, the company is still working along industriously and breaking former records. The smelter treated 3450 tons of ore

in 24 hr. a week ago, and for the week ended Feb. 29 exeeeded all former records, shipping 22,938 tons from mines to smelter. Total ore shipments for the year to date are 146,947 tons. The Granby pay-roll at the mines is $50.000, and at the smelter $30,000, per month. The mines of the Boundary shipped 29,-423,856 tons of ore during 1907, as against 30,375,-924 tons in 1906. The miners will hereafter work on 8-hr. shifts—from 8 a. m., 4 p. m., and midnight—at the Granby mines, instead of an hour earlier, as heretofore.

The following are the shipments from the eamp for the week ended March 3:

Company.	Tons
Centre Star	3,180
Le Roi	1,249
Le Roi No. 2	77
Evening Star	30
Total	5.229

The Con. Mining & Smelting Co. of Canada has issued a statement to the shareholders covering operations from July to December, 1907. The following were the shipments from their three groups:

	Tons.
Centre Star, Rossland (gold-copper)	87,451
St. Eugene, Moyle (silver-lead)	75,104
Snowshoe, Phœnix (copper-gold)	86,109
Total	248,664

The St. Eugene produced 12,110 tons of silver-lead eoneentrate. The average amount of ore received at the Trail smelter was 1116 tons per day; 42 tons of lead-silver bullion were produeed per day, at $165 per ton; copper matte, 14.8 tons, averaging $453 per ton; pig lead, 38.4 tons daily, at $79 per ton. The gross value of the output for the year approximates $6,000,000, divided as follows: Gold, 39.1; silver, 27.2; copper, 12.4, and lead, 21.3 per eent.

Another shipment of $40 ore has been made from the lower workings of the War Eagle. The ore reeently struek in the Le Roi is of the same character as that in the War Eagle.

SALT LAKE, UTAH.

Smelter Situation.—The Tintic Smelter.—Deep Mining.—Ontario Drainage Adit.

Attorneys representing the interests of the Salt Lake valley farmers, who appeared as plaintiffs in the trial of the late smoke eases, resulting in the injunetion putting the Salt Lake valley eopper smelters out of business, are preparing to make a strong effort to prevent favorable aetion of the Court in granting to the United States Smelting Co. a modified deeree permitting the latter to eontinue operating its lead smelter. This opposition of the farmers to each and every move of the United States company bears a sinister look. There appears to be no doubt about the Ameriean Smelting & Refining Co. having used money to advantage in the eampaign to obtain the end it desired. The executive committee of the farmers was unanimous in granting eoneessions to the A. S. & R. Co. and assisted in obtaining such a modifieation of the deeree as to permit a eontinuanee of operations at the Murray smelter. The United States company has built a bag-house system similar to the one ereeted by its competitor, and in some respects more eomplete; yet the farmers objeet. It is believed, however, that when the hearing on the petition of the United States company comes up on the 30th inst. the latter will make sueh a strong presentation that the application will be granted by Judge Marshall.——The management of the Tintie Smelting Co. is on the alert for ore eontraets, and the output of several of the principal mines of the Tintie distriet has been tied up for a period of five years. Ores will be received after May 1, and it is expeeted that the smelter now under eonstruetion will be ready for operation some time during that month. Being baeked by some of the wealthiest mining men in the State, this Tintie company will beeome a formidable competitor of the older custom smelting concerns in this region. The independent smelter projeet, in whieh the Utah Mine Operators' Association is interested, is said to be moving along favorably; but the projeetors are doing no talking for publication. It is asserted, however, that ground is to be broken before the end of April.

Deep mining in the Tintie distriet has been demonstrated a sueeess. All of the mines opened to 2000-ft. depth show no impairment in the orebodies. In the Mammoth mine, some of the riehest ore ever taken from that property was found at 2200 ft. The Gemini mine has been developed to 1800 ft., and the shaft is being eontinued to 2000 ft. The deepest workings in the eamp are in the Mammoth mine, at 2300 ft.——Unable to market its ores and being unsueeessful in the effort to sell the bonds authorized reeently to raise funds to eontinue development, the Lower Mammoth Mining Co. has stopped all work at its mine in the Tintie district. The eompany last year shipped its produet to the United States smelter at Bingham Junetion under eontraet; but the plant now being elosed, the mining company finds itself without a market.

The direetors of the Daly West Mining Co. have passed the quarterly dividend of $108.000. It is hardly probable that another distribution will be made until the end of the year.——The Ontario mine, at Park City, will be drained within the next sixty days. The water is reeeding at the rate of nearly five feet per day through the drill-holes driven into the main adit from the drift run around what appears to be the last eave. Sinee the first drill-hole was put through, the water has fallen, up to this time, about 160 feet.

TONOPAH, NEVADA.

The Tonopah Co.—Character of Orebody.—The Tonopah Midway.

The Tonopah Mining Co. is operating through three shafts, the Mizpah, Silver Top, and Red Plume. The Mizpah shaft is sunk on the andesite hanging wall of the Mizpah vein; the Silver Top goes down on the Valley View vein, and the Red Plume is in line with the Mizpah and, being eonnected with the others, is used for hoisting waste. The depth of the Mizpah shaft is 900 ft., with levels at 100-ft. stations, beginning with the 200. The vein strikes east-west, both walls being andesite down to the 500 or 600-ft. levels, where intrusions of porphyry and dacite were eneountered. The dip is nearly vertieal between the andesite walls, but takes a considerable dip below where these intrusions eome in. The vein in places is 33 ft. wide, but bodies of porphyry filling are found here and there between the walls, and this filling is not highly mineralized. The solid orebody attains a width of 15 ft. at different points. The gangue is quartz and the preeious metals are present in the ratio of 1 oz. gold to 90 oz. silver. The gold is considered to be mostly in a free state, but in minute particles, while the silver oeeurs as a sulphide and chloride. The iron in the ore does not exeeed 1 to 2%. In the mining operations the entire lode is treated as ore, and in passing to the shipping bins it goes over sorting tables, where about 12% of the whole, consisting of porphyrite waste, is separated. The most extensive development is between the seeond and sixth levels of the Mizpah. The drifts on the seeond level extend 700 ft. eaeh way from the shaft; on the third a drift runs 700 ft. east and 600 ft. west; on the fourth, 1000 ft. east and 600 ft. west;

on the fifth, 1000 ft. east and 800 ft. west; on the sixth, 100 ft. east and 100 ft. west. The workings below the sixth are not extensive.

The Silver Top shaft is 700 ft. deep, with extensive workings disclosing conditions similar to those in the Mizpah. As a general average there is shipped to the mills (at Millers) 350 tons per day from the Mizpah and 150 tons from the Silver Top. Ingersoll-Rand drills are used in the levels and Waugh drills in the stopes. Some of the Murphy drills are also to be tried. Electric power is employed in hoisting and driving the air-compressors. F. A. Keith is general manager, W. H. Blackburn being mine superintendent.

The directors of the Tonopah Midway Mining Co. are H. C. Brougher, J. L. Butler, Henry Anderson, R. P. Stenson, T. L. Oddie, J. J. McQuillan, and W. J. Douglass. The ore shipped during 1907 amounted to 3008 tons, the gross value being $68.51 per ton, while the cost of transportation and treatment was $20.82, leaving a net yield to the mine of $47.68 per ton. The dividends paid within the year amounted to $59,451. Development work aggregated 4088 linear feet. A north cross-cut has been driven 850 ft. from the 835-ft. level, intersecting a vein that is from 14 to 40 ft. wide, on which a drift was run westerly 300 ft., showing ore running from $2 to $17 per ton. At a point on this drift a Vulcan geared hoist was installed for use in sinking a winze in the foot-wall of the vein. This winze is now down 206 ft. and a cross-cut is being made from it through the vein. W. J. Douglass is the company's manager.

Rawhide, Nevada.

RAWHIDE, NEVADA.

The Boom.—Rich Ore.—Exaggerations.

As usual with mining booms, the public mind is unsettled as to what to believe. 'Boomers' and 'knockers' are plentiful, each looking to their individual interests. Statements are made without the least resemblance to truth, "to bite and not to be bitten," being the motto of the fortune-hunter. Even men in responsible positions, who should know better, do harm by wild statements, such as one made by a superintendent here that Balloon hill would produce a billion dollars. This is foolish, indeed, for the deepest shaft is little over 100 ft., less than 50 tons of ore has been shipped, and no returns have been made public; not over 1000 tons of milling ore is on the dumps. Such statements do more harm than good, for the men who know immediately discount even the truth.

The fact is that some streaks of very high-grade ore, assaying thousands of dollars per ton, have been discovered near the surface within a radius of two miles from Balloon hill, some hundreds of sacks of shipping ore are ready for transportation, and some thousand tons of good-grade milling ore are on the dumps. But the value of the ore is only guessed, for those that know prefer to let the 'boosters' place a fancy value on their output. The district will need cheap power to be able to mill the bulk of the ores at a profit. This will come when sufficient ore is developed to warrant the investment in plant and machinery.

The town itself has grown far beyond what the mines warrant at this early date. Every line of business is being overdone. No one should come with less than $5000, either to set up in business or to engage in legitimate mining. The larger part of the work is being done by lessees, and most of these have been unsuccessful; as the town is full of idle men, there will soon be a reaction. The idle men will have to be fed, and the problem may become serious. There is very little money changing hands on deals, and those inside are losing no time in getting out. Whether a slump is feared or money is difficult to obtain, the fact remains that payrolls are small and leases easy to obtain. There is no doubt as to the value of some of the mines, but the boom town is out of proportion to mining development. Goldfield was just the same, at first; it weathered the storm, and we may hope that Rawhide will do as well or better. Those who have endured all the discomforts of tent life on the desert during the winter months, deserve success.

Concentrates.

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

A siphon, theoretically, can lift over 30 ft., but in practice it is unsatisfactory if the lift exceeds 24 feet.

The Sarnia tunnel, on the Grand Trunk railway system, is being equipped with an a. c. single-phase locomotive. A 1000-ton train will be hauled 19,000 ft. in 15 minutes.

Mine timbers should be cut before the sap rises in the trees. The winter is the best time to cut a supply of timber, and this should be well seasoned before use. It is then lighter to handle and easier to frame.

The flow of water in a pipe is proportional to the square root of the fifth power of its diameter, other things being equal. Thus it requires 32 pipes of 3 in. diam. to carry the same flow as one pipe of 12 in. diameter.

Electric energy is measured by the product of the power and the time. The practical units are the joule, which is equal to one watt second, and the kilowatt-hour, which is equal to 2,655,000 ft. lb. or 1.34 hp. hour.

Electric power is the rate at which energy is being transformed in a circuit. It is expressed by the product of the instantaneous values of electro-motive force and current in the circuit. The practical unit is the kilowatt.

A kelvin is a name that has been suggested for the kilowatt-hour unit. A less cumbersome name than that in general use is required, and the adoption of this proposed word would be a suitable recognition of a great electrical engineer.

Greenstone is a general name for igneous rocks that are fine-grained and dark green in color. It is used when closer determination, with the microscope, is impracticable. Most of the so-called 'greenstones' are diabase or diorite.

Amygdaloid is a term applied to cellular lavas, full of almond-shaped holes, which were filled with steam at the time of consolidation and are subsequently filled with secondary minerals, as is the case in the copper-bearing rock of Lake Superior.

The amount of copper ore treated in the United States in 1906 was 20,000,000 tons, averaging 2.15% copper. The ore from the western States contained 3.65% copper and $1.70 in gold and silver. The average price of copper was 20 c. per pound.

All the coal in California is lignitic or sub-bituminous in character. There are a number of coal areas, the chief of them being the Monte Diablo and Corral Hollow fields, in Alameda and Contra Costa counties. Small quantities have been mined for local use in several other counties.

In the Tintic district, Utah, there is a good example of the enrichment of ores in the oxidized zone. The ores contained in the sedimentary rocks in this district are completely oxidized to a depth of several hundred feet, and partially to the lowest points reached in the mine workings.

Asbestos is the commercial name given to two types of fibrous mineral: one of them is actinolite or tremolite, a fibrous amphibole; the other is a fibrous variety of serpentine, known as chrysotile. Asbestos means non-combustible and the term stands for mineral fibre that resists both heat and acid.

Replacement deposits occur in difficultly soluble rocks like quartzite and granite. The formation of gold-bearing quartz veins in zones of crushing in schist, as in New Zealand, and the replacement of granitic rocks and andesites to form lead deposits in the Cascade range in Washington, are notable examples.

The uses of asbestos are constantly increasing. Of the two varieties, the chrysotile is the more valuable, especially for products involving spinning. It is spun into yarn for packing and cloth for theatre curtains. The amphibole variety of asbestos is used in the manufacture of boiler lagging, steam-pipe covering, and insulating cements. All of these uses depend on its slow conduction of heat and electricity.

Quicksilver ores are reduced by volatilization and condensation. Retort reduction is essentially a simple distillation, in which the mercury vapor is kept separate from the flame and smoke of the fire-box, while in furnace reduction all the gases enter the condenser together. In California both retorts and furnaces are employed, more than half a dozen 50-ton Scott furnaces being in use. At the Black Butte mine in Oregon a new type of furnace has recently been built, designed to treat a large tonnage of low-grade ore.

The auriferous gravels of the Sierra Nevada represent Tertiary streams which had entirely different valleys from those of the present day. Maps showing the Tertiary topography have been made by geologists, and it is seen that the present valleys are deeper, and the streams of the present day are generally at right angles to the former ones. After th old auriferous gravels were laid down, great flows of volcanic rock filled up the valleys, and as tilting occurred at the same time, the new streams followed independent courses. They have now cut down their beds so as to expose the Tertiary gravels at many points.

Amalgamation is not used in tube-mills, as this method of grinding is used for re-grinding prior to cyanidation. Amalgamation in barrels is, however, used for cleaning up battery and blanket sands. The use of mercury in barrels or tube-mills, where stones or iron are used for grinding, is not economical, owing to the flouring and subsequent sickening of the mercury which is sure to occur. If it is used, the barrels should be revolved slowly, from 12 to 16 rev. per min., and the operation continued from 8 to 24 hr. Grinding with mercury cannot be recommended in general practice, owing to the high loss of quicksilver.

Drill steel is often found to fail when hard rock is to be drilled. The loss of time from this cause is often a serious matter. The usual cause is that the steel is of inferior quality, and it pays to purchase the best on the market, and to pay wages sufficient to keep a good drill-sharpener. With good steel sharpened and tempered carefully, no serious difficulty should occur. Garnet and pyrite are the toughest minerals to drill, but by sharpening the drills with a wide bevel on the edge and carefully gauging the bits, no difficulty should be encountered. If the drill steel has been burned by inexperienced tool-sharpeners, it must be cut off, as it will be impossible to make this steel take a temper.

Discussion.

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy.

Mining Law Reformation.

The Editor:

Sir—It is time public opinion should be educated on reforms necessary in the mining laws and customs of this country, and this can be done in no better way than by starting a discussion of the subject in the MINING AND SCIENTIFIC PRESS; and, although such a movement would be best started by yourself, still, as the time is ripe, and you have not done it, I beg permission to submit a few rambling thoughts on the subject, with the hope that it may bring out others more deserving of notice, from the many men interested in the welfare of the country, so that, from the many suggestions, enough may be gathered to form the nucleus of a sane, adequate, and just mining law for our great country.

The present apex law is an absurdity, and unworthy of a progressive intelligent nation. However, it exists and must be recognized. A new law should be enacted fixing a square of some size, say, 500 ft., as a unit for all mining claims, and any locator should be allowed to take up as many units in one claim as he might desire or deem necessary.

In order to make the new law effective, the present mining laws and customs should be abrogated, and the Federal government proclaim a separation of surface-land right, and the sub-surface mineral deposits; defining surface rights to mean the land which the Government will cede to locators for agricultural or ranching purposes, transferring same as per existing laws, but reserving all rights to sub-surface mineral deposits, such as lodes of gold, silver, lead, mercury, and coal, in fact, all metals and minerals except iron and the salts, these last to belong to the owner of the surface rights.

A tax should be placed on each unit of a mining claim to be paid yearly, not as a revenue, but as a guarantee of good faith on the part of the locator, and as a means to prevent two or three locators from hogging a district to the exclusion of all others, and to the detriment of the future development of that district, which would mean a loss to the public and to the country, due to the non-development of same. Once a location were made, a patent should be issued for it within a year, and the land charged for at some specific rate per unit, say, $25, exclusive of the customary fees for patenting mining claims.

As the new law could not be made retro-active, the present law must be observed in all locations prior to promulgation of the new law. These locations should be recognized and left to take their chances before the courts as heretofore, where difficulties occur; however, it should be left optional with the owners of such claims to come in under the new law; in other words, to re-locate, where there is free ground, and where not, to voluntarily accept all boundary lines as vertical planes, as they would be considered under the new law. If possible, where lines could not be accepted as vertical planes, difficulties should be avoided under the old law, by recognizing the right of the first location, where there was conflict due to two veins running into each other, however insignificant the vein in the first location might be, if it were unbroken and persistent in depth. All lands sold prior to the promulgation of the new law would of course retain all the rights acquired with them, and the new law would only apply to the existing Government lands. All surface rights necessary for legitimate mining purposes, where needed by the mine operator for carrying on his work, should be guaranteed by law by expropriation, at a price not in excess of the current local value of the land, where such surface rights are owned by a citizen, and acquired by same after promulgation of the new mining law. Lands acquired by private citizens prior to the new law would have to be arranged for, if needed for mining purposes by the mine worker, in accord with the requirements of the present laws effecting such deals.

As human nature is rather inclined to be conservative, some exception may be taken to the unit suggested, and it may be asked how this unit would be effective in making locations. To this can be answered that it would be favorable in all cases, as will be seen from the following examples: On small lodes, or those having short ore-shoots, 500 ft. square would amply cover the valuable part of the ground to 500 ft. in depth on veins of ordinary dip. Should the dip be steep, and the vein run on the surface for a thousand feet, two claims along the strike could be taken, having the foot-wall side-line located 10 to 50 ft., or more, from foot-wall of the vein, at the option of the locator.

Should the dip be at an angle of 30°, two units could be taken on the dip, making a claim of two units long by two units wide, or 1000 by 1000 ft., a very respectable claim and one that would cover the valuable ground along any ordinary lode.

Where a vein is flat, the dip can be covered by three units; and on an ordinary vein, with such a dip, the claim would be 500, 1000, or 1500 ft. along the strike, according to its persistence on the surface, and 1500 ft. with the dip, thus covering effectively the surface indications to a reasonable depth.

If difficulties are to be avoided, and if chances for litigation are to be reduced to a minimum, and millions of dollars saved to the mine workers and investors, the necessity of some such law must be admitted. Some may say, "Why bother? We have gone too far already along the old lines; let us let bad enough alone." These can be informed that the mining industry of the country, huge as it is, is but in its infancy; and besides, it is never too late to mend. Then, let us mend.

E. A. H. TAYS.

Denver, February 18.

Electrical Hoisting.

The Editor:

Sir—A few notes on the electric hoist recently installed at the Bunker Hill mine, in Amador county, California, may prove of interest to the readers of the MINING AND SCIENTIFIC PRESS. I need not remark on the excellent workmanship of the piece of machinery nor its masterly installation. The hoist is a double-reel double-geared machine; the heads of the reels are 8 ft. diam., the gear-wheels are 9 ft. with 10-in. faces, the inside heads being bolted to the driving gears. The outside heads have a projection for lowering brakes. The two reel-shafts are 7⅞ in. diam. at the centres and the ends turned down to 7 in. to pass into the bearing-boxes. The pinion shaft is 6 in. diam., resting in three boxes projecting at one end for a spur gear which is driven by the pinions of the electric motor. The clutches are of the sliding jaw type. The machine is planned to hoist 3 tons of ore 3000 ft. The electric driver is a 16-pole, 150-hp., 60-cycle, 3-phase, 550-volt, variable speed induction motor, the full load speed being 430 rev. per minute.

A working test for the past sixty days has fully

demonstrated the surprising efficiency of this electric plant as compared to steam, even as regards perfect control and handling by the operator. The old steam hoist generated its power from fuel-oil; the average fuel expense during one year amounted to $440 per month, while the electric hoist cost $189 (or 42 hp. at approximately $4.50 per hp. per month of 30 days); in each instance an average of 3000 tons of ore per month was lifted an average of 1200 ft.; a net saving of 8⅓ cents per ton of ore hoisted.

The following tables are averages of the actual horse-power used in hoisting 1½ tons of ore 1600 ft., both with and without counter-balances. The skips when empty weigh approximately 1500 lb. each, and the cable 2 lb. per ft.; the shaft is a 60° incline.

Without Counter-balance.				With Counter-balance.			
Reading No.	W_1	W_2	Hp.	Reading No.	W_1	W_2	Hp.
1	125	370	199	1	140	328	188
2	140	314	182	2	90	232	130
3	123	266	156	3	115*	228	138
4	114	258	149	4	70	206	111
5	108	244	142	5	56	190	99
6	104	240	138	6	41	164	83
7	99	232	133	7	24	150	70
8	92	232	130	8	7	137	58
Readings on watt-meters at intervals of 10 seconds.				Readings on watt-meters at intervals of 15 seconds.			

* Motor brake applied; bad place in shaft for 20 feet.

A. M. Yonge.

Jackson, California, February 21.

Mining in Rhodesia.

The Editor:

Sir—In the last issue of the Press, your London correspondent states that "there is another reason why the population does not increase in Rhodesia, namely, the opposition of the present settlers to the dumping of criminals and ne'er-do-weels in their midst."

Surely your correspondent does not know his Rhodesia when he makes such a statement, for, during a prolonged residence in that country, I never heard of that point ever being raised. As a matter of fact, Rhodesia has never been a dumping ground for either of the above classes, and only such as would naturally come to a new mining country have found their way there. It may be that the absence of any marvelously rich camps, like Coolgardie, Tonopah, or Goldfield, and the lack of any great gold rushes, did not make the country sufficiently attractive for the lawless class; but, be that as it may, the fact remains that Rhodesia has probably one of the most law-abiding populations of any mining country in the world, and moreover, labor-unions are an unknown quantity there.

So far as the criminal class is concerned, the absence of crime in Rhodesia (and also at Johannesburg in the ante-bellum days) has been most remarkable. Highwaymen and murderers are almost unknown, while the tin-horn gambler, with his faro lay-out and his three-card-monte game, has scarcely ever been seen in the country. To those of us who have been familiar with the lawless condition of affairs which generally prevailed at such places as Leadville, Tombstone, and similar mining camps, where the six-shooter was the usual Court of Appeal and where the holding-up of the stage-coach was an easy method of recouping fallen fortunes, the entire immunity from these conditions has been a great surprise, and it certainly speaks well for the law-abiding nature of the ordinary Briton. The general freedom from crime in the Rand in early days made people careless, as they felt so secure, and I have frequently carried several thousand pounds sterling (for my pay-rolls) in an open buggy across 10 miles of lonely veldt, without any other protection than a revolver, and never thought anything of it.

Rhodesia has been producing gold bullion for the past ten years and, to my certain knowledge, there has only been one bullion hold-up (that of a private conveyance) during the entire decade. Before the extension of the railway north of Bulawayo, it was customary to send all the bullion by stage-coach from the different mines to either Bulawayo or Salisbury, and scarcely ordinary precautions were taken to safeguard it. The bullion would generally be put in the boot of the stage, in care of the driver, who did not even carry a shotgun, and a hold-up would have been the easiest thing in the world. The carrying of the bullion, in fact, was very casual, as the following amusing incident will illustrate: During one rainy season, the stage carrying the bullion from a well-known mine, got mired in vlei, or swamp, along the road, and it was necessary to unload the stage completely before it could be pulled out. During the process, the bullion was placed against the trunk of a tree on high ground for safe-keeping, and it was not until the stage had reached a station 40 miles away that the driver discovered that his bullion was one bar short! In the meantime an Italian, traveling in the opposite direction, happened to find the missing bar and reported his discovery to the officials at the nearest town; he was promptly put under arrest, despite his protests, for stealing the bullion, and it was only after the real facts became known that he was released.

There has always been a certain amount of amalgam stealing, and doubtless high-grading takes place at the richer mines, but this is common to every mining country, and we need not go far from home to meet with these conditions.

From the foregoing, it is difficult to understand how your correspondent could possibly make a "comparison with Western America." As far as the prosperity of the country is concerned, Sir George Farrar, one of the leading mine operators of Johannesburg, is quite enthusiastic over the mining outlook in Rhodesia, and he has invested a good deal of money there. While only a few of the large mining companies are paying dividends, the tributor and lessee, who is contributing one-third of the total gold output, or nearly 20,000 oz. monthly, is doing well, and the country is sharing in his prosperity.

E. H. Garthwaite.

Oakland, California, February 27.

RECENT VOLCANIC ERUPTIONS IN BERING SEA.

Written for the MINING AND SCIENTIFIC PRESS
By ARTHUR S. EAKLE.

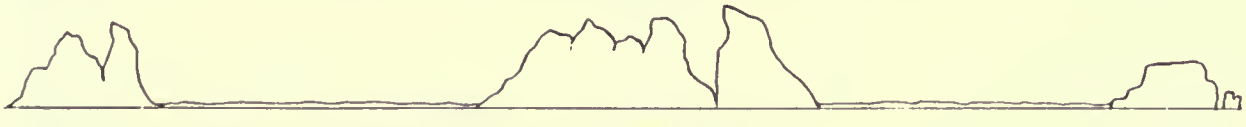
A report comes to us from Nome, Alaska, that a shower of ashes fell in that vicinity on the 26th and 27th of last November, which covered the snow with a layer of black dust, one-fourth of an inch thick, near Nome, and the layer was said to increase in thickness toward the north. Many square miles of territory are known to have been covered by the shower. Some of this ash was scraped from the ice of Bering Sea and sent to the MINING AND SCIENTIFIC PRESS by a reader for examination.

The ash appears as a dark brown, almost black, powder, and under the microscope is seen to consist wholly of minute particles of dark-brown volcanic glass. It has evidently been formed by the violent explosion of an obsidian cone or mountain, and, judging from its finely powdered condition, it has probably been transported a long distance from the seat of eruption by the winds, perhaps from the Siberian coast, as the wind was blowing from that direction at the time.

Volcanic activity is still manifested among the islands of Bering Sea. The long chain of the Aleutian Islands, stretching westward in a curve for a distance of nearly 1000 miles from the Alaska peninsula, contains several volcanoes still showing signs of activity and others now dormant or extinct, which have been active in recent years. Last summer Akutan was sending up intermittently a huge column of vapor, which spread out above into the well known cauliflower or umbrella shape, similar to the smoke column that hung over San Francisco during the recent conflagration. Mt. Makushin on Unalaska and Korovinski on Atka island had their high snow-clad summits almost constantly enveloped by dense clouds of vapor, arising from their craters.

One of the best illustrations of the formation and destruction of land by volcanic eruption is seen in the history of Bogosloff island, which rises in the Bering Sea, about 50 miles northwest of Unalaska island. In 1776 Ship Rock was observed and in 1796 Castle Rock or Bogosloff was thrown up. Nearly a century later, about 1884, Fire island arose, distant about one mile from Castle Rock. In 1891 Ship Rock was destroyed by an eruption, leaving Castle Rock and Fire island as two peaks, separated by a wide and deep channel. In May, 1906, the *Albatross* reported a new cone midway between these two islands, which received the name Metcalf cone. The revenue cutter *Perry* visited the island in July of that year and the name Perry peak was given to this new cone without knowledge of its prior name. Metcalf peak was still separate from Castle Rock by a channel, seven fathoms deep, but was connected with Fire island by a narrow isthmus a few feet above the sea. Last summer in July, just a year later, a new cone was found to have arisen 450 ft. high, from the base of Metcalf on its south side. It had been formed partly from uplift and partly by the splitting asunder of Metcalf cone. It was observed first by the cutter *McCulloch* and received the name McCulloch peak. The former channel between Metcalf cone and Castle Rock became filled and the land raised and extended by this eruption, so what appeared formerly as separate islands became one island about 1½ miles long and ¼ mile wide. This island can properly be called Bogosloff.

On the seventh day of last August, the writer spent about four hours on Bogosloff island, collecting rocks for a future report. Castle Rock had long since become cold; Fire island had lost its fire, and its surface was cold and no steam issued from its crevices; Metcalf and McCulloch peaks were hot, steam and sulphur vapors poured out from the many crevices on the sides and sulphur was depositing as yellow patches in the cooler places. A lagoon of boiling salt water colored yellow by sulphur partly surrounded McCulloch peak. Hornblende-andesite, basalt, basaltic agglomerate, and pumice formed the make-up of these peaks. Some of the rock boulders contained much disseminated pyrite. The island was inhabited by countless thousands of gulls and puffins, which had made their nests on Castle Rock and Fire island, and by hundreds of sea-lions. On September 1, three weeks after the writer chipped rocks from the hot sides of these peaks, McCulloch peak exploded and ashes fell in the town of Unalaska, 60 miles distant. The entire aspect of the island became changed by this volcanic outburst. The position of McCulloch peak is now occupied by a lagoon, great quantities of débris have covered the other peaks, the connecting land has been raised, and the island is penetrated by several lagoons. The dust which fell from this explosion is a gray pumiceous ash, containing an occasional crystal of hornblende. It is evidently finely shattered hornblende-andesite.



The Peaks of Bogosloff Island From the Coast Side, as Seen on August 7, 1907.

At the beginning of July, 1907, the 1500-kg. Heroult electric furnace employed at Lindenberg's steel works in Remscheid, Germany, turned out its 2000th charge. It had been at work continuously since March, 1906, treating a charge previously melted in a Siemens-Martin metallurgical furnace. The dolomite bed of the Heroult furnace was repaired after every charge, and a new cover made of silicious material was required every three to seven weeks; in other respects the furnace lasted well.

CRUSHING ORE.

Written for the MINING AND SCIENTIFIC PRESS
By M. P. BOSS.

*A true seeker of knowledge is not content to know of a fact without knowing why it is a fact and to be able to fully analyze it. To an engineer and expert capable of intelligently analyzing a matter or condition, the bare knowledge of a fact seems not fully conclusive, without the application of the test of enlightened reasoning, and to him, capability to analyze correctly, counts for more than a bundle of information supposedly correct. The latter may be bought in books, for a dollar or two, while the former is the judgment and personality of the man and is transferable only by reflection. It is the object in the following pages to elucidate some fundamental principles, as the writer has found them, and to put the student mind into a train of analytic reasoning, upon the subject in hand. There has been and is such a multiplicity of devices to make coarse ore fine, that it would be a great undertaking to treat the subject exhaustively, and such is not the object of this essay.

Ores and rock for commercial purposes, taken from the earth, are crushed to a degree of fineness suitable to requirements, which may be as coarse as several inches in diameter or it may be too fine for measurement. An example of extreme fineness may be seen in water that is slightly discolored by earthy matter after having been for some time in repose. Each piece or particle so crushed represents fracture or cleavage to the extent of its superficial area. Rock fractures are irregular and particles resulting from fracturing are variable in size. They can be measured with only approximating correctness by passing them through apertures of a specific size A, followed by passing over apertures of smaller size B, and the product that does not pass B may be described as passing A but not passing B. But even this approximation is subject to variation with different types of crushing. The product from some crushing may be slivered and angular, while from other methods of crushing it may be worn and rounded. The sum of areas of fracture in an accumulation of crushed particles is not computable, but to give to the mind some approximating conception we may assume that a cubic inch of quartz (or other substance) is fractured into true and equal cubes 0.002 inch in diameter. This would represent an area of fracture or cleavage of 1500 square inches, minus six square inches (the superficial area of the one cubic inch) or 1494 sq. in. actual fracture. A cubic foot thus divided would represent 17,994 sq. ft. of fracture or cleavage area, and 13 sq. ft. of fracture, or approximately one ton, would represent an area of 233,967 sq. ft. of cleavage.

Fracture that is effected mechanically represents a consumption of power proportionate to the hardness and toughness of the material, plus the loss in the mechanical application. In all power applied mechanically there is necessarily a loss in friction of the mechanism, and in power applied to crushing ore there is also a loss in its application to the rock being crushed. Wear of parts in contact with the rock represents a part of this loss. There may be a serious loss of power within the mass of material being crushed, by friction and by compression, that is ineffectual in crushing.

Ore is crushed by compression between two crushing members; by grinding between two crushing members; or by impact against a crushing member. A crushing device to be effective must not only have power applied economically to the crushing proper, but it must systematically and properly supply fresh material to the crushing and as systematically discharge the material when sufficiently crushed. Hence we may, for convenience and analysis, segregate the crushing of ore, as popularly considered, into three stages, thus: Supply, getting the material into the crushing field; fracturing, or the act of actual crushing; and discharge, getting the properly crushed material away from the crushing field. Errors of design for crushing are less conspicuous to the ordinary observer in the first and third stages than in fracturing. Crushing devices may be continuous in action upon a material or they may be periodic. Crushing devices of periodic action may be cumulative of power during the non-crushing moment, or they may be non-cumulative. Chilean mills, rolls, barrels, and disc grinders are examples of continuous action. Stamps accumulate power while they are being raised, all of which, less the friction involved, is expended at the moment of arrest from fall. Jaw and gyratory crushers are periodic in action and non-cumulative, except in the equalizing effect of the fly-wheel.

Crushing between two members may be classified: 1. Faces parallel and reciprocal in action, exemplified by the stamp. 2. Faces parallel and non-reciprocal, as exemplified by grinding pans and disc grinders. 3. Two vertical and more or less diverging plane surfaces, with reciprocal action, exemplified by jaw-crushers. 4. A circular member, with internal face, within which operates a smaller circular member with external face, the axis of which is a revolving incline, popularly called gyratory. 5. A plane surface over which passes a cylindrical one, having a horizontal axis, exemplified by the Chilean mill. 6. Two cylindrical external surfaces with horizontal axes, exemplified by rolls. 7. A cylindrical internal surface, the axis of which is vertical, within which revolves a smaller cylindrical external surface of vertical or nearly vertical axis, exemplified by the Huntington and Griffin types of mill. 8. A cylindrical internal surface, the axis of which is horizontal, within which revolves a smaller cylindrical external surface of horizontal axis.

These several types of crushing between two members have many modifications, some of which do not come within the foregoing description, as, for instance, the Chilean mill sometimes is built with rollers inclined inward, to neutralize the centrifugal energy, in which case the ring-die is properly coned, to give parallel faces to the two members. Another instance is what might be termed a modification of

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the grinding pan, substituting a crushing aetion for that of grinding, by making the muller mildly conical, the axis of whieh, in operation, is a revolving ineline. Crushing by impact against a crushing member is effeeted: 1st, by hurling it from a rapidly revolving meehanism; 2nd, hurling it by eompressed air or steam; 3rd, by dropping it from a height.

Wear of crushing members in action is necessarily constant, but is variable in degree, the chief modifying factors being the quality of the metal of which they are made, the angle of pressure on the surface

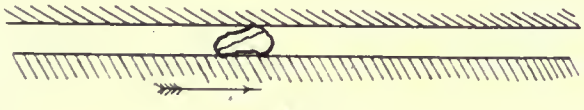


Fig. 1.

An enlarged section, showing a particle of ore between two grinding discs, and how it may be fractured, when caught by slightly penetrating the grinding surface.

and the distribution and movement of the material being aeted upon. Crushing members that reciprocate and have faces that are parallel or faces that do not greatly diverge at point of pressure should have extreme hardness as their predominating quality, whereas, faces that are parallel and have a grinding action, or faces that have a wide angle of divergenee, toughness shonld be the predominating quality. A stamp falling directly upon broken ore has chiefly to withstand direct penetration, but a grinder consisting of two parallel discs, pressing axially together, one of which revolves, or the two revolve in opposite directions, have an effect upon grains of material to disintegrate them in two ways: 1st, to wear them away by rubbing over their surfaces; 2nd, to fracture them by detrusive* resistanee.

If the discs are of glassy hardness they will glide over the particles, but if they are less hard and have a quality of toughness, the grains will penetrate the surfaces enough to become caught and ruptured. In the former ease the discs will wear proportionately more than in the latter, while the effeetiveness in crushing will be less.

Crushing by reeiprocal action between two parallel faces results in minimum wear of crushing members, unless modified by conditions. Detrusion of crushing members increases with angle of divergence. Angle of divergenee of pressure in a crush-

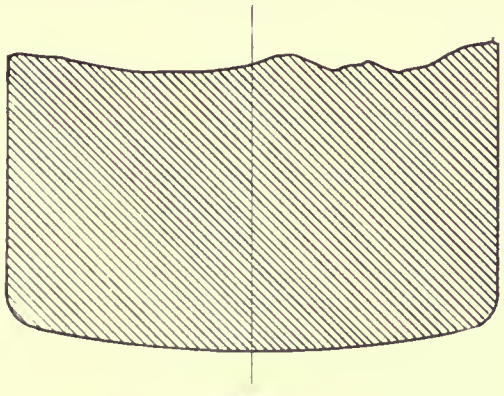


Fig. 3.

Section showing convex face of stamp-shoe, approximately as worn by operating upon a thick bit of material.

ing device, have one or both crushing members with an exterior cylindrieal faee, is greater upon a piece of material of a given size than it is upon a smaller piece of material.

Compression upon a bed of material between two

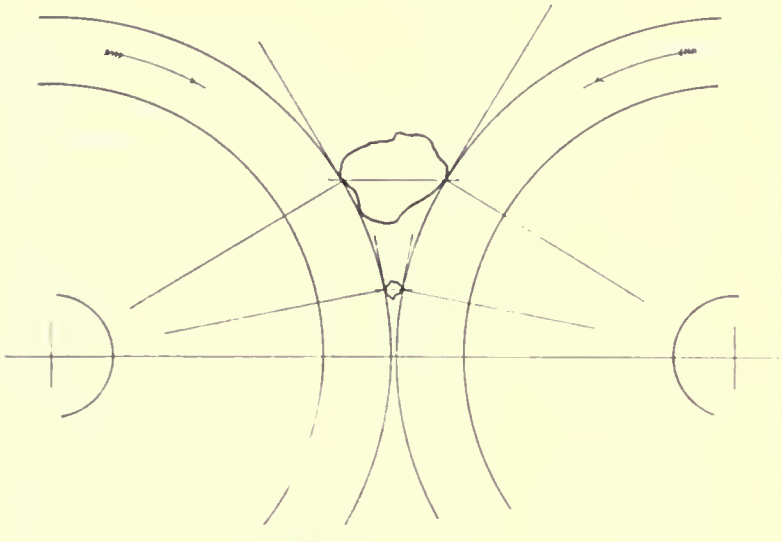


Fig. 2.

Rolls showing how pressure lines increase in directness with decreasing size of piece operated upon and how small pieces must be less detrusive in effect than larger ones.

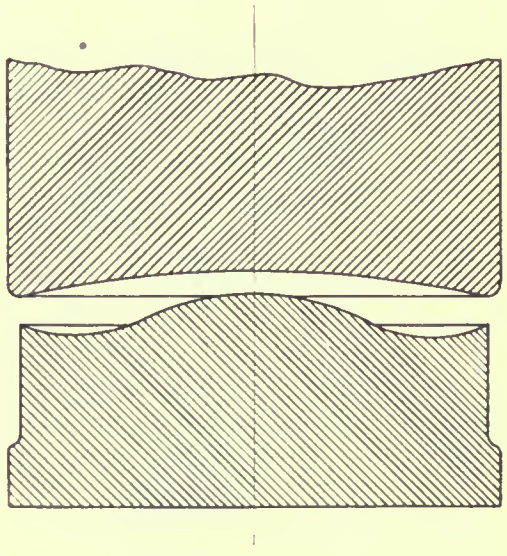


Fig. 4.

Section showing faces of stamp-shoe and die, approximately as worn under favorable conditions and with close fitting guides.

crushing members will have varying effects, as modified by conditions. If an individual piece contacts two crushing surfaces in line with their approachment, and if the approachment is at right angles with the surfaces, the crushing is accomplished with maximum efficieney, there being minimum friction and less of power. If the component pieces of a bed of material have less diameter than the thickness of the bed the wedging effect of particles between particles diverts a part of the force in a lateral direction. If the power of compression is sufficient to crush in this diverted lateral direction, it is effi-

*'Detrusion' is the act of thrusting or driving down. Editor.

cient, but if the bed of material is so thick that the diverted lateral pressure does not crush, the force thus diverted is absorbed and lost.

A stamp-shoe compressing upon a die, compresses with greatest force at its centre, there being lateral relief at its periphery. If the surface of the die is lower than the discharge, material banks about it, more or less, and there is no detrusion on the periphery below its working face. A shoe in falling is exposed to the attrition at its periphery of pieces lying partly within its path and by particles being expelled by the lateral diverted force of compression. This results in detrusion of the periphery of the shoe beyond its face.

When a stamp operates in an approximately true path, as with iron guides, compensation for this peripheral wear should be given by making the die smaller in diameter than the shoe.

A stamp-shoe that is operated upon a thin working layer of material over the die wears to a face somewhat concave with a slightly rounded edge at the periphery.

A stamp-shoe that is operated upon a thick layer of material over the die wears to a convex face with well rounded edge at the periphery. The cause for the first is due to there being but little outwardly expelled material at the shoe contact and the wear being chiefly proportionate to degree of compression, which is greatest at the centre and has lateral relief near the periphery. The cause for a convex face on a stamp-shoe is that in operating upon a thick bed, expulsion of material is confined and restricted and practically equalizes the degree of compression over the bed operated upon and as attrition is greatest away from the centre, the shoe is most worn at and toward its periphery.

While a stamp-shoe and die have been cited as having crushing surfaces parallel, and being practically so when new, in wear they become only approximately parallel. Reasons have been given for the wearing of the face of the shoe away from a straight line and also why the periphery of a die does not wear below its surface. The face of a die under ordinarily good conditions wears declining from the centre to its lowest point a little away from its periphery toward which it gently inclines upward.

Wear on the face of a die is mostly by attrition from the forcing outward over its face, the material under pressure from the effect of the blow of the stamp. The outward movement is least at the centre, but increases toward the periphery, but as the pressure is relieved at that point the detrusion is lessened.

There are idiosyncrasies of wear of crushing members. Deep pockets sometimes wear in dies. The primary cause for these may be a soft spot or a blow-hole, but once started they are increased and deepened by attrition from lateral movement of particles under pressure, by coarser pieces over the depression being forced downward by the blow of the stamp.

The first stage of crushing, that of introducing into the crushing field the material to be crushed, applies not alone to the fresh material but to the reintroduction, or distribution, of material already in process of being crushed. Jaw and gyratory crushers, rolls and disc grinders, that are not grinding pans, act only upon freshly introduced material, which falls away after it has passed the crushing zone. Chilean mills crush only the material that settles upon the path of the rollers and all freshly introduced material as well as all that is insufficiently crushed must continue to lodge upon that path after each passage of the roller, an action that involves some period of time, and limits the efficient speed of the mill. Roller-mills having vertical axes and which crush by centrifugal energy, operate upon material that is thrown against the path of the rollers by the operation of the mill, for which, time is an element for efficiency, as a roller following its predecessor too quickly will pass before the material has found firm lodgment against the vertical path, or on the other hand, if the roller follows too tardily, the lodgment is at its ebb.

Grinding pans, having two horizontal faces, one of which revolves, operate submerged in a material, from which it feeds without discrimination, and into which it discharges its finished product.

Individual stamps are fed by gravity and rush of semi-liquid material to fill vacancy left by upward moving shoe, and from which place it is in turn violently expelled by the return drop of the stamp. Stamps grouped in mortars are fed by splash from other stamps, as well as by back flow.

A device that is best adopted for coarse crushing is not well adapted to fine crushing. It seems quite natural to classify crushing into three stages: coarse, medium, and fine.

For crushing from coarse to medium, jaw and gyratory crushers are mostly used; for crushing from medium to fine, stamps, Chilean mills, and rolls are most prevalent; and for a very fine product, tube-mills, Chilean mills, and grinding pans. On the softer material, centrifugal roller-mills are largely in use, for both medium and for fine grinding.

In both jaw and gyratory crushers the material reaches the crushing field and also discharges from it by gravity, without frictional loss. With these machines, however, there is an important loss by friction of the mechanism, by detrusion, and by the lateral divergence of force that does not crush.

A stamp falling upon a die over which there is a depth of some inches of water, with ore in proper quantity for effective crushing, displaces water and fine particles with great energy, not only to the extent of the cubic measurement of the submerged part of the stamp, but the surrounding water and material is driven outward and upward by that which is so rapidly forced horizontally outward from under the shoe. In this action, at the moment before the arrest of fall, the water is rushed outward over the underlying larger pieces of material with much force, washing by this means the finer particles from under the shoe before the moment of crushing.

The natural course of the material expelled from under the shoe is parabolic, the initial movement being horizontal and its direction of least resistance upward. At the rise of the stamp and into the vacuum created, water rushes and pieces drop back by

gravity, and when other stamps are dropping into the same mortar, the splash from these other stamps adds to the amount to receive the succeeding blow. If, however, the die is but little submerged, when the stamp is at rest, the expulsion of water, at the fall of the stamp, being so much less, the washing effect over the face of the die is proportionately milder, the parabolic course less pronounced and the splash over the screen is weak and limited, especially is this the case if the mortar is wide. Under such circumstances a portion of the sufficiently crushed material splashed screenward fails to reach exposure over the screen surface, from the effect of the expelling blow. Ore that is easily crushed thickens the water that is used in the crushing, much more than does a hard tough ore. The requirements for crushing such an ore are not so exacting as to width of mortar. The thicker pulp keeps more in mass to resist the falling stamp and surges better over the screen surface, whether it is wide or narrow.

A stamp dropping 100 times per minute and crushing 6 tons in 24 hours, would crush an average of $^{1}/_{12}$ of a pound at each blow, or less than a depth of $^{1}/_{32}$ of an inch over a die 8½ inches in diameter.

As the faces of stamp-shoes and dies do not coincide closely in outline, it follows that most of the finely crushed material is produced by the effective pressure of particles between particles. The concave face of the shoe serves to confine the particles under pressure within, against lateral pressure. Under such conditions the crushing efficiency increases with the force of the blow. The force of a blow from a gravity-stamp is due to weight of stamp and length of drop.

A heavy stamp occupies but little more mill-space than a light one and has no more working parts. Its manipulation in re-shoeing and repairs is, however, more laborious.

A stamp dropping evenly upon a die that is unconfined, expels radially with equal force. If the die is encompassed by a concentric wall sloping so as mildly to compress the natural parabolic line of discharge, and if at proper height this wall has above it a concentric screen properly affixed, the expulsion from under the stamp and upward over the screen, and the return of the coarser particles by their gravity and the suction from the rising stamp is regular and even throughout, and the exposure to the screen-surface of the particles direct from under the stamp is at a maximum. Any break or disturbance from this even course is necessarily a departure from the maximum. A stamp dropping upon a die that is one of a group within a mortar, dispels over a screen-surface only a fraction of its product and an important percentage of the passable product returns again to the crushing field. In the former case, a minimum amount of slime is made and a high proportion of screened product nearly up to passable screen size, whereas, by the latter, slime is made and the material discharged through the screen will average finer and the product will be less even in size. Thus under similar conditions, the output from an individual stamp should be greater through a given screen, than from a stamp grouped in a mortar with others. Stamps grouped in a mortar require less room, have less working parts, and are simpler to operate than a like number of individual stamps.

The gravity-stamp is a mechanism of simple con-

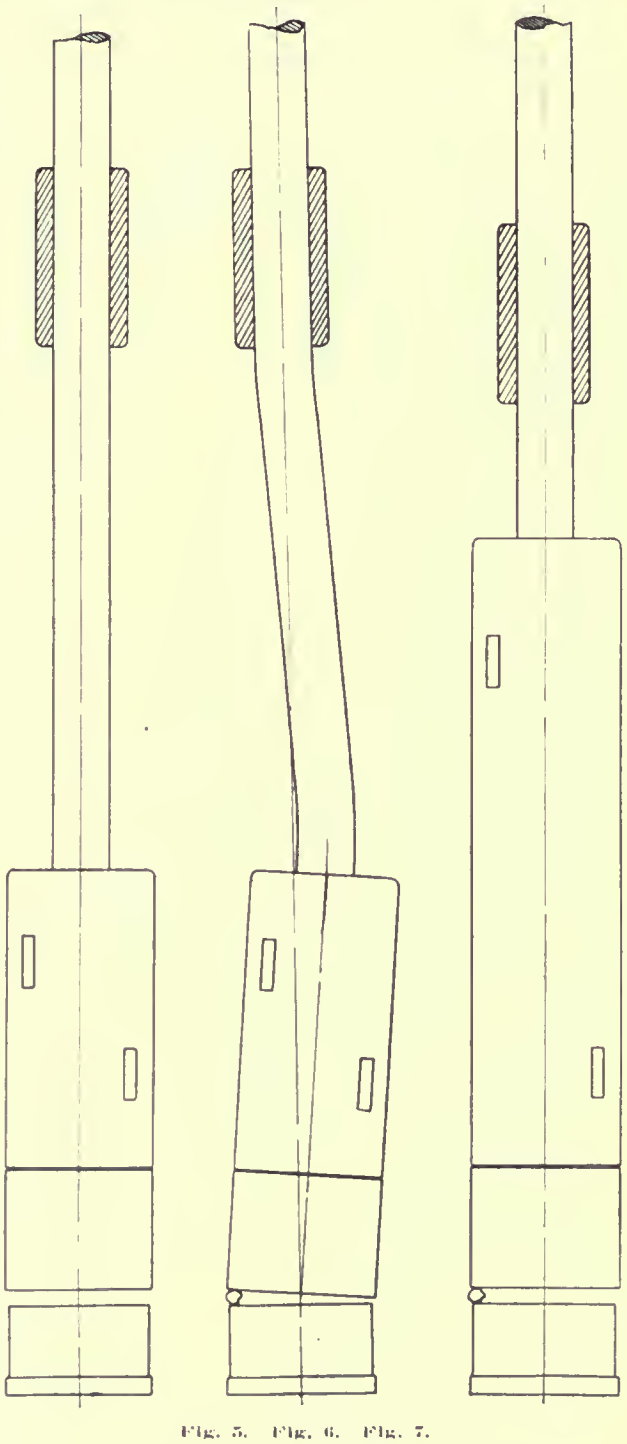


Fig. 5. Fig. 6. Fig. 7.

Fig. 5 shows a stamp of common design and proportions. Fig. 6 is the same stamp, showing (by exaggeration) how the stem is caused to spring. The spring is followed by vibration and continued vibrations cause stem breakages. Fig 7 shows how stem vibration is so minimized that breakage of stems rarely occurs. A long stamp-head, with the lower guide set low, permits but little spring.

struction and its wearing parts are easily renewable. The regularly recurring drop of stamps, in action, generates vibration of the foundation and framework, which is the one trying element of construction. An individual blow from a stamp creates but small square-inch pressure at the bottom of the

mortar, but the rhythmic recurrence of drops vibrates even the earth upon which it stands, sometimes noticeable hundreds of feet underground. There are two sources from which this vibration is generated; first, from the cam-shaft in picking up the stamps, and second, from the mortar that receives the blows. Low and flat foundations are better to minimize vibration than high pedestals.

The vibration in the stem of the stamp is distinct from, and independent of, the vibration in the foundations of the battery. The material upon which a stamp falls is uneven in size and is not evenly distributed over the die, so that the arrest of the blow will usually be mostly away from the axial centre of the stamp, which will give a lateral strain or wrench to the stem. The vibrating effect of this strain upon the stem varies with the structural design. A high centre of gravity of the stamp, the lower guide high above the die, and guides wide apart, are factors conducive of vibration. The stems in such a battery construction usually will begin to break after having been about a year in operation.

By making the stamp-head long and the stem not unnecessarily so, thereby bringing the centre of gravity low, and by putting the lower guide as close to the head as its convenience of operation will admit, the vibration of the stem will be so minimized that breakage is practically eliminated from consideration. Heavy stamps that operate rapidly by steam, upon a thick bed of material, crush largely by particles between particles. They are remarkably efficient for coarse crushing.

A vertical roller running over a horizontal circular track (a Chilean mill) drives liquid pulp before it in a direction tangential to its track, which direction leads away from the crushing zone. If the confining rim or wall of the mill is sloping, the material flows upward in its onward course until its propellant force is abated, at which moment it recedes, more or less, to the crushing zone. If this recession of material is interrupted by an on-coming roller, it in turn obstructs the natural flow generated by that roller. If in the sloping rim there is an encircling belt of screen, the flow over it, if uninterrupted, will be uniform and regular and a high percentage of the fines will be liberated through the screen. On the other hand, if rollers follow one another so quickly that the return of the flow is interrupted, a portion of the confined material, that is sufficiently fine, is restrained from screen contact. Furthermore, if the flow is not interrupted, its containing coarser material will largely have found rest upon the crushing track, in proper position to receive the on-coming roller. In other words, it may be said, if proper space of time elapses between the passing of the rollers, the coarser material gets into position most efficient to the crushing, and if this coarser material has not reached that point of rest, it is an element of obstruction to the systematic exposure of fines over the screen.

In such a mill as described, more material is deposited upon the outer confines of the track than upon the inner. To remedy or ameliorate this defect, the track is sometimes made the truncate of a cone, instead of being a true plane. In other cases the track is made very narrow, to minimize the difficulty, and yet at other times scrapers are employed to equalize the material over the path.

A vertical roller, the tire to which is cylindrical, passing over a circular track, has a forward slip at the larger circumference of track and a backward slip at its smaller circumference, between the two there is a neutral point where there is no slip. In the operation of crushing rock, this neutral point varies in radial distance from the axis, around which the roller revolves, a hard substance raising the roller clear of other contact would, for the time, become the neutral point, irrespective of its radial distance. With a given width of tire, the slip, in making a circuit, is approximately the same on a track of small diameter than it is over one of large diameter. The percentage of slip to travel is in ratio with diameters. The friction from this slip is a resistance to the departure of the roller from a straight line of travel and augments the outward centrifugal thrust.

All outward thrust that is resisted otherwise than upon the material being crushed is lost force. To utilize this lost energy, different modifications are employed.

If a roller runs upon a circular track, the face of which is an inverted truncate of a cone, it will maintain its equilibrium without thrust, either outward or inward, when the speed is properly gauged to the angle of incline. If, however, the speed is unduly slow there will be an inward thrust upon the shaft collar, but if the speed is excessive, the thrust will be outward. The requisite for speed increases when the roller is more inclined from the vertical.

If the axis of a roller is parallel to a diameter line of the circular track and at a distance behind it, the line of rotation of the roller will be tangent to a radius shorter than the radius of the track. Inasmuch as the roller travels on the track radius, it follows that there must be a side slip to the extent of the difference of length of the two radii. This slip is a resistance counter to centrifugal force and they may be adjusted to entirely neutralize. Thus the resistance to centrifugal energy, in such a case, is wholly through the bed of material.

If a roller having a cylindrical tire, passing over a circular track, is horizontally trunioned to the driving mechanism, at right angles to the roller axis and at some point below it, centrifugal energy exerted above the trunion centre is diverted downward upon the crushing, by the trunion pull. This may be termed a plus quantity. The centrifugal energy below the trunion, in like manner is diverted upward and is a minus quantity. The difference between the two represents the amount of centrifugal energy utilized upon the crushing. The energy that is not utilized is resisted by the trunion.

In the passage of a vertical roller over a circular track which is a true plane, the material is thrown outward and when it flows back, more of the material is deposited near the outer periphery of the track than farther inward. As at this point the roller slip is forward, the pressure is greater than

at the point of neutrality, while where the roller slip is backward, the crushing pressure is less. For these reasons the working efficiency is greater at the point where the slip is forward. This work has an effect upon the working faces of the mechanism that is peculiar and very pronounced, when the roller tire is wide and the path upon which it runs is of small circumference. At the edges of the track the pressure is low because of the lateral relief without the crushing zone. At these points the wear is minimum. A little inward from the outer periphery, where the pressure is greatest the wear is very pronounced and deep. At the neutral point it becomes less again, from which place it increases

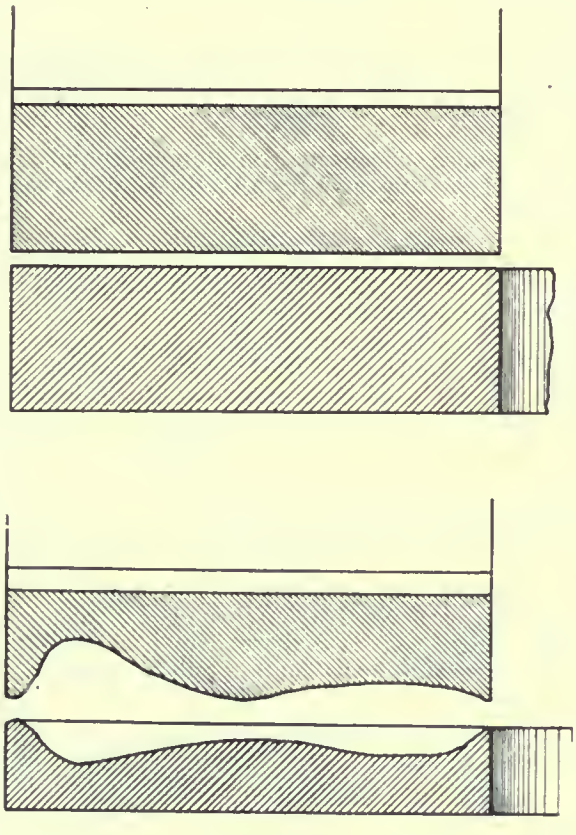


Fig. 11.

This is approximately the outlines of wear of tire and track in a Chilean mill having a wide tire and a track of small circumference.

in depth to a point a little removed from the inner edge of the track. With this class of crushing, vibration is not an important factor.

From the foregoing, a natural deduction favors a narrow crushing zone, having a track of liberal circumference.

Horizontal rolls do but little crushing of particles between particles and the material passes the crushing field without recurrence. As wear across the face of the roll cannot be true and even, the product cannot be made uniformly very fine, but under conditions where the rock pieces are not so large as to give too obtuse an angle of pressure and where the pieces of ore enter the crushing zone at a speed approximately the same as the periphery of the rolls, the work that they do is with small loss of power. The wear and the care of rolls is a matter of importance.

A horizontal roller running over a track, the face

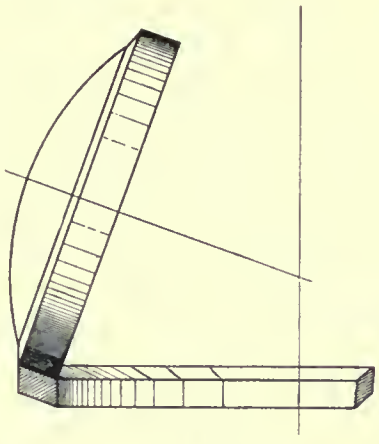


Fig. 8.

This shows a Chilean roller operating upon a track that is an inverted truncate of a cone, to neutralize centrifugal thrust.

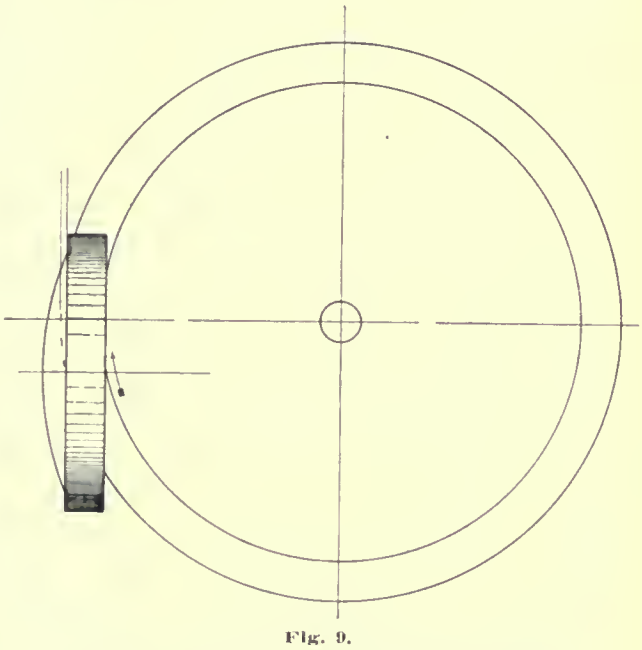


Fig. 9.

The axis of this roller is behind the diameter line, but parallel to it, which gives counter resistance to centrifugal thrust.

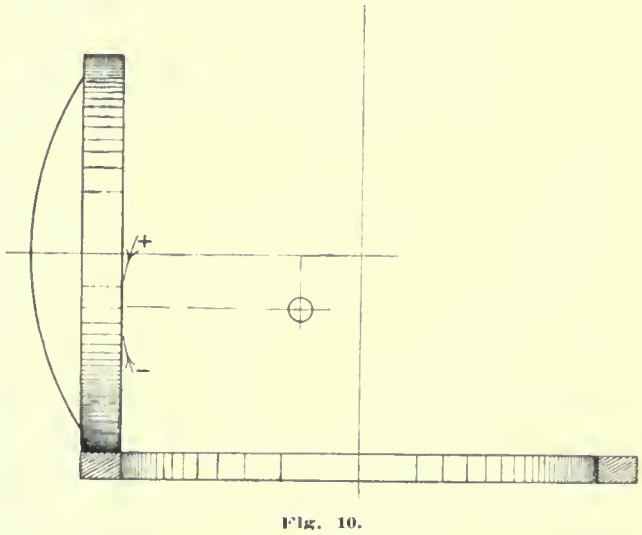


Fig. 10.

A trunion centre is here shown in its relation to a Chilean roller, to which it is attached. The downwardly diverted thrust is shown with plus sign and the resisting upward thrust is shown by a minus sign.

of which is vertical, acts with centrifugal energy upon the material caught between the two faces. From

the nature of conditions, in this class of crushing, there is little crushing of particles between particles, but it is almost wholly done by direct contact between working faces. Speed, to generate pressure, is an essential element with this type of crusher, but the passage of rollers over the path must be properly timed, to catch the material against the track at the proper moment, and it is a requisite condition that the body of moving material shall not be excessive within the mill.

Grinding pans which operate upon a material into which the finished product is discharged, work against a heavy discount of efficiency, as the feed is encumbered with an increasing amount of material that should have been permanently expelled from the crushing field. When grinding between two discs is desired, the highest efficiency and economy is attained by a flow through and away, with the finished product. If the lower disc is made to revolve, it, by centrifugal action, assists the feed between the discs and better keeps alive and in action the material upon it which is being treated. Dise grinders, when properly conditioned, do not altogether rub over and wear away the particles, but they also fracture, more or less, the larger particles. One feature of disc-grinding is, that the coarser particles between the discs are the ones that contact and are acted upon. Discs, to operate with highest efficiency, should contact closely at and near their outer periphery, but should be slightly apart toward their centre, at the point of feed. This is accomplished by cutting open spaces in the discs radially from the centre extending but partly across its base. Disc grinders are very simple in design and of low cost.

Tube-mills containing pebbles for grinding, present an exceedingly great amount of very cheap grinding surface, as each pebble is a grinder. In this feature tube-mills are incomparable with any other class of grinder. However, the material that becomes fine near the feed end must continue on through the tube. Grinding in tube-mills effects no selection of the coarser particles, amidst the pebbles, to be acted upon, but action is with equal facility upon all particles within the field. The loss, within the mill, by friction that is inefficient in grinding is probably great.

From the foregoing, it appears that stamps and Chilean mills, when best constructed and operated, forcefully wash over the material bed, in advance of the crushing moment, and the fine, carried by the wash, passes directly to screen exposure. With such action a high percentage of duty is obtained.

Stamps, Chilean mills, and rolls are pioneers in the ore-crushing field. They are each of them simple in design and are durable. It seems probable that they will continue permanently, under various modifications, as popular crushers. Aside from these, there are many devices that have been more or less successfully used, especially in the centrifugal roller class. Sensational claims for peculiar devices appear from time to time, but it must be kept in mind that to put coarse ore that is hard and tough into fine particles consumes power.

The Prospector.

Enquiries sent to this department are answered free of charge, if submitted by subscribers who are not in arrears. The full name and post-office address of the sender must be given, otherwise no answer will be made. Those who are not subscribers must accompany their questions with a fee of $3 for each question. No assays are made.

NOTICE.—Owing to the large number of specimens forwarded to this department, it has been found necessary to make a charge of 25 cents (to subscribers) for each determination, in future.

A specimen of sanidine trachyte was received from C. E. B., of Seattle.

W. B. MeC., of Helvetia, Ariz., sends a specimen of hornblende-diorite.

A. & Sons, Joseph, Idaho, sends: No. 1, hornblende; No. 2, magnetite.

The two specimens from H. W., of Burrough, Cal., are: No. 1, mica-schist; No. 2, manganese dioxide and limonite.

A specimen of quartz containing thin plates of specular hematite came from G. B. W., of Aguascalientes, Mexico.

A. T. T., of Arizpe, Mex., sends a specimen of volcanic breccia, made up of angular fragments of rhyolite and quartz-porphyry.

The rocks sent by W. B. H., of San Francisco, are: No. 1, diorite, somewhat schistose; No. 2, kaolinized rock, perhaps an altered diorite.

T. B. T., of Codova, Alaska, sends: No. 1 and 2, quartzite stained with copper oxide; No. 3, chalcocite and bornite; No. 4, bornite.

The rock samples sent by C. A. F., of Jacksonville, Cal., are: No. 1, talc-schist; No. 2, mica-schist; No. 3, quartz vein in diabase; No. 4, chlorite-schist. All of these specimens contain cubes of pyrite.

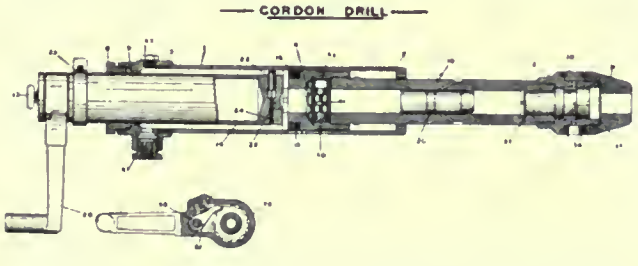
W. L. G., of Fairview, Nev., sends: No. 1, quartzite; No. 2, hematite; No. 3, quartzite; No. 4, basalt; No. 5, basalt; No. 6, quartzite with oxidized pyrite; No. 7 and 8, calcite: No. 9, quartzite and limonite.

Engineering theory and practice are rapidly extending with the general advancement of our economic interests, and the engineer, whether he be a young graduate or otherwise, who does not make use of the modern aids to information, among which are to be counted scientific societies and a personal association with his brethren, with the innumerable hints and suggestions which come from these, will soon be found struggling with what seems to him adverse fate, but what in reality is inferior knowledge, behind-hand knowledge, or, plainly speaking, ignorance, greater or less. The engineering world has passed by him, and he must view the working out of the law of the survival of the fittest with what grace he may.—C. W. Hunt.

Moss copper, which is frequently seen on copper matte, is due to the decrease of solubility of copper metal in copper matte as the temperature decreases. Solid solutions obey many of the same laws as liquid solutions, and thus many obscure phenomena can be explained.

DRILL CONTEST ON THE RAND.

Stope-drills is the all-absorbing topic on the Rand. The question of replacing the 53,000 Chinamen who are now about to leave the Rand has been the incentive for a thorough investigation. The leading mining paper in the Transvaal, *South African Mines*, has shown great enterprise in offering a prize for the best small rock-drill as demonstrated in open competition under carefully selected judges. The large amount of special information on the subject that has been obtained thereby, will prove of immediate value, and should bring about tangible results in the reduction of working costs, because the contest has given the data upon which a useful discussion can be based. About 300,000 ft. of drill-holes are being drilled each day at a cost of £20,000, and if manual labor can be replaced by a cheaper mechanical hammer, there will be from 2000 to 5000 machines used in the mines of Johannesburg. That any method will find universal application is unlikely, but the remarkable results obtained in the competition show that this phase of engineering



has been sadly neglected by mechanical engineers, who only too often consider that their responsibility ends at the collar of the shaft.

Comparisons between drills, under conditions as uniform as possible, are of the greatest value if properly interpreted, in giving information concerning certain phases of drilling, such as design of the machinery and actual speed of drilling. Of the cost of maintenance and repairs, little can be ascertained except by continued use. The trials have borne unexpected fruit and if properly interpreted, they afford valuable data for engineers in the selection of machines. Every engineer has had the experience of interviews with manufacturers' agents each of whom could explain exactly why his own particular machine was 100% better than that of any competitor. The mine managers at Johannesburg now have the results, carefully tabulated, of a series of tests made under identical conditions with a view to testing the mechanical efficiency of the machine on the surface and under working conditions. The results are surprising, and we can deduce more than mere generalizations.

The Gordon drill did the best work. It is named after W. D. Gordon, the American vice-consul at Johannesburg, and was put on the market by the Ingersoll Rand Co. The average for a full four days run was 1.69 inches of drill-hole per minute, a truly remarkable performance as compared, for instance, with Kaffir hammer-boys. In the hands of a native this drill has proved its ability to drill 11 to 12 holes, 3 ft. in depth, in less than 5 hours. The figures prove the superiority of the hammer type over that of reciprocating or percussive drills. The percussive machine of the present day has nearly reached the highest possible efficiency of this type of rock drill, and it is doubtful if it will ever show much increase in drilling power. More economic valve motions may be designed as far as air-consumption is concerned. Hammer-drills are still in their infancy, but the work done per pound of weight far excells that of the percussion type. The present tendency is to revert to the principle of the single-hand hammer, by making a machine that merely strikes the drill without withdrawing the drill at each stroke.

The drills were tested at the surface by two runs of four hours each in granite, the air being supplied at 50-lb. pressure for the first trial and at 60 lb. for the second.* The size of holes was to be 1¼ in. at the bottom. The holes drilled in the contest were to be from 36 to 45 in. deep and the drills operated by one man without a helper. The contest was decided on footage and time, as no estimates could be made of cost of maintenance or repairs.

The following table shows the depth drilled in the surface tests and the percentage increase obtained by the additional 10-lb. pressure. The amount of air used was not measured, but the pressure was kept constant. The following table also shows the piston or hammer displacement of each drill:

Name of Drill.	Depth Drilled at 50-lb. Air-Pressure.		Depth Drilled at 60-lb. Air-Pressure.		Increase in depth.	Piston or hammer at 50-lb.	Displacement per min. at 60-lb.
	Ft.	In.	Ft.	In.	%	Cu. In.	Cu. In.
Kimber	12	11¾	16	11	30.6	Not determined.	Not determined.
Little Wonder	16	7⅞	19	11⅜	19.7	8,460	9,964
Gordon	28	4⅞	36	9¼	29 5	5,617	6,771
Little Kid	15	9⅜	22	6⅛	42.6	6,782	7,928
Baby Ingersoll	25	3	29	6½	17.0	10,945	12,736
Flottmann	18	9⅜	25	4⅜	34.4	10,395	12,166
Little Holman	14	4¼	17	0¼	18.6	7,065	8,321
Chersen	26	5¼	33	2	26.0	18,868	20,648
				Mean Increase	27.3		

The underground tests consisted in drilling 8 down-holes and 8 up-holes at the angle of the lode.

Drill.	Type.	Weight, Lb.	Cylinder, In.	Stroke, In.	Feed, In.	Average drilling in inches per min. dry holes.	Average drilling in inches per min. wet holes.
Gordon	Hammer	72⅝	1 13/16	10	10	1.74	1.82
Little Wonder	Piston	118½	2	6	10		0.68
Kimber	Hammer	110	3⅛	3	12		
Little Kid	Piston	102½	2	5	18	0.12	0.82
Baby Ingersoll	Piston	129½	2¼	5	15	0.53	1.16
Little Holman	Piston	97½	2	5	16	0.32	1.21
Chersen	Piston	113⅝	2¼	6	18	0.27	1.11

*The air-pressure used will impress American mine managers as being too low. The inefficiency of low pressures is now receiving more attention on the Rand. Small drills, as a class, require higher pressures than large ones, and the hammer type than reciprocating machines.

and setting up in a new position for each set of four holes.

The trials differed from ordinary practice in so far as the drill in the stope is set up each time a hole is drilled. The following table gives the results and some details of construction of each drill.

Of these drills, most are too heavy to be considered one-man drills, and only those weighing less than 80 lb. can be considered suitable for a single operator. In addition to the above drills, the Flottmann and Hardsoeg drills, weighing respectively 52¼ and 44¼ lb. were represented. These machines, however, did not finish the tests, owing to inferior steel and other causes, and little information as to their value was obtained.

A feature of importance in stoping drills is that they must be easy to set up quickly and light enough to take into the stopes. On the Rand, and in many districts where the veins are narrow, only one hole is drilled at each placement of the drill, and it is important that the holes be arranged so that, in blasting, full advantage is taken of each seam or selvage in the rock. It is in this respect that machine-drills have been vastly inferior to hand-labor for stoping narrow deposits. In this connection we note that one of the most striking features of the contest at Johannesburg was the rapidity with which the Gordon drill was erected and adjusted and its steel changed. Bolts were entirely absent on the column and arm, their place being taken by steel wedges. Much time was undoubtedly saved by this simple and effective device, and it would be interesting to know whether the idea would give satisfaction with the heavier blows of reciprocating machines. In order to derive the greatest benefits from small machines, they have to be erected several times in the course of a shift, so that full advantage may be taken of all slips and places of weakness in the rock. In this respect the Gordon is useful, as it is entirely free from projections and is cylindrical in form. Bad drill-steel was also the cause of much trouble, and the importance of careful tempering and gauging was clearly demonstrated. The Gordon was the only drill that used water in the 'uppers,' and to this is largely due its remarkable performance. The water is fed through the hollow drill to the bit, and by this means the hole is kept clean and the steel cool, while all danger of phthesis, due to the inhalation of dust by the operators, is entirely eliminated. With the 200 Gordons just received at the Rand Mines Ltd. and the Little Kid and others already at work, it is to be hoped that the problem of cost will be investigated. The question of wear and tear, of the wages that will be demanded by the operators, and the advances that will undoubtedly be made in the design of these drills, are questions which time alone can solve, but there is no doubt that these tests will prove of the utmost value to the manufacturer of the drill and the manager of the mine, whether in South Africa or elsewhere.

Prospecting for tin has been often carried out in Trabuco canyon in southern California, and a small quantity of ore produced.

Decisions Relating to Mining.

Specially reported for the MINING AND SCIENTIFIC PRESS.

The owner of all the coal, gases, salt water, oil, and minerals of every kind and description, in, upon, and under a certain tract of land supposed to contain a certain number of acres, together with rights of way and mining rights, is not the owner of such an estate as will entitle him to maintain an action for partition. The rule has been stated thus: A grant of an undivided interest in a piece of mining ground expressly conditioned that no rights are conveyed, except a mining right upon the premises, vests in the vendee only the right of taking from the land any minerals or ores contained in it, to the extent of the interest granted. He does not by virtue of the conveyance become a co-partner, joint tenant, or tenant in common with the vendor in the land itself. His interest is not an estate which can be the subject of an action for partition.

Robertson Land Co. *v.* Paull, (W. Va.) 59 Southeast. 1085, Dec., '07.

Where a person undertook to 'jump' a mining claim on the theory that the required amount of assessment work for a particular year had not been done, he was not permitted to assert thereafter a forfeitnre of title for failure of the original locator to comply with the rules of the mining district, respecting the giving of notices of location, where such original locator had gone beyond the preliminary notice and marked the outlines of the claim, and such re-locator had full knowledge of the location and boundaries of the original claim, and where he undertook to locate his new claim precisely within the boundaries of the old one. The concrete rule is that a person with full knowledge of a former location and of the outlines of the claim cannot re-locate the claim within the same boundaries on the ground that the assessment work had not been done, and then claim a forfeiture on the ground that the notices required by the mining district regulations had not been given.

Yosemite Mining Co. *v.* Emerson, 28 Sup. Ct. Rep. (U. S.) 196, Jan., '08.

On failure to perform the assessment work, a mining claim is open to re-location in the same manner as if no location had ever been made, provided the original locators, their heirs, assigns, or legal representatives have not resumed work on the claim after failure and before such re-location. But where there has been a failure to perform the assessment work within the time specified, but the original locator, after such failure had, in good faith, resumed work upon the claim, the claim is not then subject to re-location, on the ground of the original failure. Whether or not such work has been resumed is a question of fact; and when a trial court or jury has so found, such finding will not be disturbed on appeal.

Yosemite Mining Co. *v.* Emerson, 28 Sup. Ct. Rep. (U. S.) 196, Jan., '08.

The extraction of coal by one tenant in common of a mine, without the consent of the other, is regarded as waste, for which he is liable to account. He will not be heard to say that his co-tenant may proceed to take coal from other parts of the vein or mine owned in common. While the coal in land is partible, still there is an appreciable element of uncertainty touching it, great enough to forbid a court of equity from depriving a party of his right in what is in the land for what may never be there. Hence, one tenant in common who has taken coal from the common mine, cannot compel his co-tenants to take their share in undeveloped land with its coal which they could mine if they chose, but must account to them for their share of the money received for the coal mine.

Robertson Land Co. *v.* Paull, (W. Va.) 59 Southeast. 1085, Dec., '07.

COAL IN COAHUILA.

Written for the MINING AND SCIENTIFIC PRESS
By EZEQUIEL ORDOÑEZ.

Everybody knows that the State of Coahuila is the only actual coal-producing region in the whole of Mexico, though several coal districts exist in some of the other States, such as Sonora, Puebla, Guerrero, Oaxaca, and a large belt of unknown importance on the Gulf coast of Veracruz. Various conditions prevailing in these regions have made difficult a thorough knowledge of their real importance as producers of fuel, although there is in Mexico a constant demand for coal to supply the needs of industry, apart from the consumption of mining and metallurgical operations and railroads. Among the unfavorable factors are the lack of railroad transport, want of sufficient capital available, and a certain absence of confidence due to the general idea that these coal deposits are not sufficiently extensive to guarantee such a large production as is required to insure a profit or an adequate return on the large capital to be invested. On the other hand the strong encouragement given by railroad companies to the importation of fuel from northern America is detrimental to the exploitation of Mexican resources and places the coal industry of Mexico in weak position to meet competition.

With a revision of coal tariffs by the Mexican Government and a reasonable taxation on the import of coal, the coal industry of Mexico would become prosperous and it could take rank among the best investment business of the country. It is possible that the Government may shortly be persuaded to take measures to protect in some degree the home coal industry in view of the large amount of capital that is being invested; especially in the coal measures of the State of Coahuila. In any case, any legislation ought to recognize the difference in the quality between the national and the foreign coals: the Mexican is inferior because it has less heating power, a large content of ashes, and is unsuitable for certain uses.

The more protection the Mexican Government gives to the home coal industry, the more encouragement there will be not only to prospect and develop the new coalfields, but the tendency will be to enlarge the present producing capacity of the Coahuila mines, as many of them are now open and preparing new working places, new slopes, and big shafts, erecting plants for washing, building coke-ovens, and so forth.

Such favorable action by the Government would not injure the foreign coal interests nor home railways, since our coal industry is owned in small measure by foreign capital and the railways will secure the profit attending the increasing domestic coal transportation.

Of the 2,000,000 tons of coal and coke consumed yearly in this country, at least 1,000,000 is produced in Mexico, and perhaps a little more: all this coal comes from the Coahuila mines. This coal fills only the needs of the northern part of Mexico and a little export to Texas. The Coahuila coal cannot enter into competition with the foreign product coming by sea from the ports of Veracruz and Tampico on account of the better grade of the latter and the cheaper transportation it obtains.

It is believed that our coal will be better in quality if the producers pay more attention to their deliveries, adopting better methods of classification and washing improved in order to extract the impurities that it always contains, due to a slate bed present between the two thick beds of coal existing in the Coahuila formation.

We do not expect to see Mexican coal cheapened at once, although we may hope to get a better class of fuel, because the cost of production is more likely to increase than to diminish on account of the use of foreign labor. It is well known among coal investors and engineers that Mexican labor is probably one of the least efficient in coal mines, although it gives excellent service in the metal mines. The Mexican miner has a horror of the coal mines and never understands how to guard against the danger of the gas. If he goes to the coal mines it is because he has become discouraged in his effort to get work elsewhere, and is attracted by the better pay.

The Coahuila coalfields cover a triangular space, of which one side is the Rio Grande from northwest of C. P. Diaz to near Laredo, that is, a little more than 100 miles. The other two sides extend from a little north of Monclova to C. P. Diaz, and from Monclova point to Laredo. That means a surface of about 3500 square miles with some extensive barren lagoons in its interior. Inside of this large territory two kinds of coal are found. One, occupying an almost uninterrupted belt along the Grande river, gives a brown coal; the rest of the surface gives coal of the coking class. The coking coal is interbedded in the Upper Cretaceous rocks or Laramie formation, which in Coahuila forms a number of large and small basins closely connected, that is, separated from each other by narrow anticlines. In general, the coal basins are shallow, the synclinal axes rarely go as far as 600 ft. deep.

The Upper Cretaceous formation in which the coking coal occurs consists of three well marked series of rocks, two underlying the coal beds and the other containing it. The deepest series, called the Peyotes division, is composed of a great number of thick beds of limestone containing *Inoceramus* and divided by thin beds of black shale. The second series is best known in the southern basins; we call it the Rubio or Monclova shale; it is a thick and homogeneous group of shales separated by thin beds of limestone and sandstone, all of which are highly fossiliferous. The coal series itself, known as the Las Esperanzas formation, is composed of shale and sandstone, both rocks sometimes very thick. Groups of sandstone beds reach a thickness of 40 to 50 ft. and the shale is sometimes as much as 100 ft. During exploitation trouble has arisen in some places on account of a slight faulting of the beds. There are gradations from shale to sandstone and the latter varies in composition, some of it being very silicious. The sandstone is generally called *piedra de amolar*, others are calcareous, glauconitic, etc. The shale sometimes passes into soft marl and is then

called 'blue mud.' In shallow basins the sandstone comes close to the coal beds, with intercalations of thin shale, but the upper wall of the coal bed itself is always soft. This makes exploitation expensive on account of the heavy timbering required.

As said before, there are generally two coal beds separated by a hard shale and each coal bed contains some hard and thin carbonaceous shale called 'bone' by miners. The upper coal bed is always thinner than the lower coal seam. The former ranges from one to six feet thick, the latter from four to eight feet thick and rarely more.

The character of the coal is shown by the following data: Sp. gr., 1.40; volatile matter, 16%; fixed carbon, 60 to 65%; ashes, from 12 to 18%; moisture, about 1%; coke, about 80 per cent.

The basins most exploited are the Las Esperanzas and Sabinas, the latter extending on both sides of the Sabinas river. In this tract systematic work was begun about 18 years ago and it soon gave signs of being an important coalfield. Two or three new basins have been discovered recently, some of them much more important in extent than the old discoveries. One of these is the Saltillito basin, where some work has been commenced. Drilling and prospecting are in progress, with satisfactory results, adding to the territory available for future exploitation and increasing the known area of each basin.

The entire coal industry in Coahuila represents a capitalization of nearly 35,000,000 pesos. It gives occupation to 7000 people and moves nearly 100 carloads daily over the International Railroad, the centre of distribution being at Monclova.

The production of coke is an important industry and represents the proper use of the Coahuila coal, for most of this coal gives a coke comparable in quality to the foreign coke.

When those parts of Mexico that contain anthracite and coking coal are exploited on a proper scale, the country will get coal for every purpose and will render unnecessary the importation of foreign fuel.

The Coahuila coal basins are operated by the following companies, some of them having started only lately: The Coahuila Coal & Coke Co., The Mexican Coal & Coke Co., The Compañia Carbonifera del Norte, The Compañia Carbonifera de La Rosita, Compañia Carbonifera de la Agujita, Compañia Carbonifera de Lampacitas, Compañia Carbonifera de San Blas, Compañia Carbonifera de C. P. Diaz, and the Compañia Carbonifera de Rio Grande.

Map of Mexico.

Primary Bornite in Colorado.—Bornite and chalcopyrite occur as rock-minerals at the Evergreen mine, at Apex, Gilpin county, Colorado. There is here a dike of eruptive rock composed of quartz, orthoclase, albite, augite of the aegirine variety, and long needles of enstatite and diallage. It is 3 to 12 ft. wide and can be traced at the surface 1500 ft. Some of the ore of the mine has been produced by secondary deposition along cracks in the neighboring rock, but a large proportion of the ore is found in the dike itself. Unaltered bornite and chalcocite grains occur as inclusions in the quartz, feldspar, and augite, and in the clusters made by the needles of enstatite and diallage. These copper sulphides must have come up dissolved in the magma at the time of its ascent to form the dike, and must have crystallized together with the silicates in the eruptive rock.

QUICKSILVER MINES OF OREGON.

In the last volume of 'Mineral Resources of the United States,' just issued by the United States Geological Survey, the following is said regarding the quicksilver resources of Oregon:

"Oregon had been a small producer for several years, but in 1906 had it not been for a new producing property, its production would have been nothing. The main operator in 1906 was the Almaden Gold & Quicksilver Co., at Howard, Crook county. The most extensively developed property in the State, the Black Butte mine, which also has a thorough equipment with a special furnace and retort, is understood to have remained idle. Considerable prospecting was carried on in Jackson, Josephine, and Douglas counties, and several occurrences of ore of good grade are reported. The greatest activity was in Meadows district, in Jackson county, where a depth of 400 ft. is stated to have been reached and a furnace and retort erected.

"At the Black Butte quicksilver mine in Lane county, Oregon, an experimental furnace, designed by and named after the general manager of the property, and known as the Dennis roasting furnace, was built in 1905, but was not operated in 1906, as the mine was not producing. It was constructed to secure, at minimum cost, perfect combustion for a large tonnage of low-grade ore. The small furnace comprised a series of primary and secondary combustion chambers and a number of other special devices, including one for preventing loss by the escape of raw-ore dust. In test-runs it is reported to have afforded a thorough roast of ore and volatilization of values in four hours, and to have eliminated practically all loss through flue-dust."

Later information is available as follows: During the year 1907 the Black Butte mine, referred to above, was equipped with a new and extensive plant consisting of a hydro-electric power and lighting plant; a crushing plant composed of the buildings and ore-bins, arranged on the gravity plan, having a storage capacity of 600 tons, and crushing capacity of 200 tons per day of 12 hours, equipped with a Sturtevant coarse-ore crusher and a Gates gyratory fine-ore crusher; a new special designed dryer built of brick, concrete, and iron, having a capacity of 125 tons; and a condensing plant, constructed and arranged after the special design of the manager of the property, which successfully discharges the furnace gases at or below atmospheric temperature, thereby insuring perfect condensation and no loss of silver, either chemically or mechanically. The old Scott furnace on the property has been re-modeled, and further improved by the addition of a specially designed wood-gas producer. The draft is produced by two No. 70 Sturtevant exhausters direct connected to a 35-hp. variable-speed motor, and so arranged that one or both can be operated at one time. The entire plant is constructed and arranged after the design of the patents recently granted by the United States and all important countries, to W. B. Dennis, the manager of the property, and is the outgrowth of the experimental work mentioned in the above quotation from the Government report.

The new plant at Black Butte was started on February 1, and its operation up to the present is said to have been most satisfactory. Quicksilver is reduced from the crude ore into pure metal in market form, and is shipped in wrought iron bottles in car-load lots to New York. An imposing looking village has grown up at Black Butte, 42 miles south of Eugene, as a result of this industry. The mine is owned largely by Mr. Dennis and Portland and Seattle associates. It is one of the heavy tax-payers of Lane county, and is becoming one of the important industries of the State.

Swedish Nickel Ores.—Until about twenty years ago the manufacture of nickel was a flourishing industry in Sweden; it then became depressed through foreign competition, especially of the Orford Copper Co., of Bayonne, New Jersey. This company smelts a Canadian ore, containing copper and nickel, with charcoal and sulphate of soda, in an upright furnace. The greater part of the nickel sulphide remains insoluble, although the sodium sulphide found in the furnace dissolves a large part of the copper sulphide; when the molten mass cools, it settles in an upper layer containing chiefly copper and a lower layer chiefly nickel. By three repetitions of this treatment there is produced a nickel sulphide containing about 1% copper; this is pulverized in a ball-mill, steeped in water to dissolve small quantities of sodium sulphide, and then in dilute sulphuric acid, which dissolves the small quantity of iron sulphide present. By further processes, copper, cobalt, silver platinum, and palladium are separated; the protoxide of nickel remaining is smelted with charcoal to produce metallic nickel. Swedish nickel ores in general contain too much iron and too little nickel to be worked on the Orford plan. It has been suggested that, as the larger part of the metallic nickel manufactured is employed for making nickel steel, the direct production of nickel steel is the only way in which poor Swedish nickel ore can be utilized advantageously. Magnetite pyrite containing 1 to 3% nickel and free from arsenic and phosporus are available. They admit of very simple treatment; the sulphurous gases driven off in roasting them are utilized for making sulphuric acid. The roasted regulus, briquetted and smelted with charcoal, forms nickel iron containing somewhat more than 3% nickel, in which state there is the largest field for its use.

In a large blast made at Smartsville to break a bank of hard cement 80 ft. high, an adit was run in 85 ft. and cross-drifts 45 ft. long were driven at either side from the end of the drift, and at 40 ft. from the entrance. At the end and centre of each drift, two 'lifters' were driven at right angles to it, extending respectively half way to the next cross-drifts and to the face of the bank. After charging the cross-drifts the main drift was tamped and the 450 kegs of powder exploded by electricity. The bank was exposed on two sides for the blast.

COMMERCIAL PARAGRAPHS.

THE A. LESCHEN & SONS ROPE CO. has moved its Denver office and warehouse to No. 1649 and 1651 Wazee Street.

THE SULLIVAN MACHINERY CO. has issued Bulletin 60A, describing hammer drills. The pamphlet gives valuable information about this useful type of machine.

'Cores' is an attractive catalogue published by the CYCLONE DRILL CO., of Orrville, Ohio. It describes the various uses to which these drills can be put, and some useful cost data.

THE AMERICAN SPIRAL PIPE WORKS, of Chicago, announces that it will send to all those interested, circular No. 21, descriptive of its rivited pipe, forged steel flanges, and cast-iron fittings.

THE WOOD DRILL WORKS, of Paterson, N. J., will be represented henceforth in Mexico south of the 23rd parallel by the International Machinery & Engineering Co., Edificio de la Mutua, Mexico City.

THE SWEETLAND FILTER PRESS, which is described in detail in a pamphlet sent by the makers, reduces the cost of labor to a minimum. The machine is made by the Sweetland Filter Press Co., 314-315 Merchants Trust Bdg., Los Angeles, California.

THE SMOOTH-ON MFG. CO. has published a leaflet descriptive of the development and uses of Smooth-On iron cements. The company has established offices at 61-69 Jefferson St., Chicago, Ill.; 20 Sacramento St., San Francisco, Cal.; and at 8 White St., Moorfields, London, E. C.

THE JACOBSON MACHINE MFG. CO., of Warren, Pa., have recently established a southern office at Atlanta, Ga., at which point they will carry a full stock of gas and gasoline engines; also a stock of repair parts. This business will be in charge of C. R. Morrison, who has for some time been traveling representative in the Southern States. The office and store-room is at 676 Marietta St., Atlanta. This company is one of the concerns engaged in the manufacturing of gas and gasoline engines that has not experienced any decrease in the orders received, nor volume of business done.

L. S. PIERCE, 1650 Champa St., Denver, recently shipped two 20-ton Pierce amalgamators through the Allis-Chalmers Co. to Johannesburg, Transvaal; one complete placer machine to Frank M. Barnes, White Hills, Ariz., for use on the Colorado River placers; two 20-ton machines to the Butterfly Terrible M. Co., near Ophir, Colo.; one 20-ton plant to the Texas Flat Mines Co., Raymond, Cal.; two 38 by 47 in., 150 tons each, machines to the Philadelphia Exploration L. & M. Co. of Philadelphia to Gold Hill, B. C. These machines are used in stamp-mills, cyanide plants, placer work, and on gold dredges.

THE ROBINS NEW CONVEYOR CO., which has been recently incorporated, will be operated under the management of Thomas Robins, who founded the Robins Conveying Belt Co. in 1896 and was president of that concern until March, 1907, when its management passed into other hands. The position of chief engineer in the new company is filled by C. Kemble Baldwin, who has served in the Robins Conveying Belt Co. in the same capacity for the last seven years. The offices of the company are at 38 Wall St. and 1240 Old Colony Bdg., Chicago.

THE DEARBORN DRUG & CHEMICAL CO. announces that at the recent directors' meeting officers for the ensuing year were elected, following the purchase of the holdings of the late Wm. H. Edgar and those of C. M. Eddy by Robt. F. Carr and associates. Mr. Eddy has decided to devote all of his time to his personal business interests. The following officers are now in control of this well known company's extensive interests: Robt. F. Carr, president and general manager; George R. Carr, vice-president; Grant W. Spear, vice-president; Wm. B. McVicker, vice-president and eastern manager; J. D. Purcell, assistant general manager; W. A. Converse, assistant secretary and chemical director; R. R. Browning, assistant treasurer; A. E. Carpenter, superintendent.

BOOKS RECEIVED.

'How to Read Plans.' By Charles G. Peker. 60 pages, with drawings. Cloth. Price 50 cents. This little book is to teach how to interpret plans and how to work from a drawing.

'Wilson's Mining Laws,' annotated, with forms and corporation laws of Arizona. By Calvert Wilson. Third edition. 140 pages. Price 50 cents, paper; $1, cloth. This is a useful handbook and has commanded a ready sale among mine operators. For sale by the MINING AND SCIENTIFIC PRESS.

'Mine Gases and Explosions.' By J. T. Beard. John Wiley & Sons. Price $3. 402 pages. This volume treats the subject in a simple way, explaining fully the fundamental principles of chemistry and physics as they apply to the subject. Safety lamps are also described in some detail. For sale by the MINING AND SCIENTIFIC PRESS.

'Analysis of Mixed Paints, Color Pigments and Varnishes,' by C. D. Holley and E. F. Ladd. J. Wiley & Sons. 238 pages. $2.50. This is a concise work on the analysis of paints and paint products. The book enables a chemist of ordinary experience to make a complete analysis of any paint, and also furnishes sufficient data so that the results of the analysis may be interpreted in a rational way. For sale by the MINING AND SCIENTIFIC PRESS.

'Modern Pigments and Their Vehicles.' F. Maire. J. Wiley & Sons. 266 pages. $2. The purpose of this volume is to give a brief history of all valuable pigments useful in painting, and describe the main sources of their derivation and supply; their properties and chief uses; their qualities, and best methods of detecting adulteration. The book is written for the men who use or sell pigments and those who want to know what to expect of them. For sale by the MINING AND SCIENTIFIC PRESS.

'Metallurgy of Iron and Steel.' By Bradley Stoughton. Hill Publishing Co. Price $3. 500 pages. This book covers every phase of iron and steel processes, with a number of interesting illustrations. The author, a graduate of Yale and the Massachusetts Institute of Technology, has had considerable experience in designing, erecting, and managing steel works, and consequently writes in an understanding way. The book is not laborious or difficult. For sale by the MINING AND SCIENTIFIC PRESS.

PUBLICATIONS RECEIVED.

The following folios of the U. S. Geologic Atlas have been published: No. 154, Winslow folio, Arkansas-Indian Territory, and No. 155, Ann Arbor folio, Michigan.

'Ninth Annual Report of the Mining Industry of Idaho,' for the year 1907. By Robert N. Bell, State Inspector of Mines. 216 pages. Illustrated. This is a highly creditable volume; it contains much useful and interesting information carefully compiled.

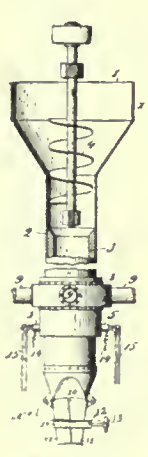
We have received the following bulletins from the U. S. Geological Survey: No. 326, 'On the Arkansas Coal Field,' by Arthur J. Collier; No. 334, on 'The Burning of Coals Without Smoke in Boiler Plants'; and No. 339, on 'The Purchase of Coal Under Government and Commercial Specification on the Basis of Its Heating Value,' both by D. T. Randall.

'The Geology of the Coromandel Subdivision, Hauraki, Auckland.' By Colin Fraser, assisted by James Henry Adams. Published by the New Zealand Geological Survey. This is one of those conscientiously prepared and admirably illustrated monographs for which the New Zealand Survey has made a deserved reputation. It is interesting to note that the gold veins occurring in the Tertiary volcanics of the Coromandel peninsula are like those of the Thames district in so far as their formation is due to solutions ascending from some rock deeper than any now exposed at the surface. In this regard the authors, after making tests on the encasing country, are in accord with J. R. Dow.

MINING AND METALLURGICAL PATENTS.

Specially Reported for the MINING AND SCIENTIFIC PRESS.

ORE-REDUCING FURNACE.—No. 874,527. James McLoughlin, Rye, New York.



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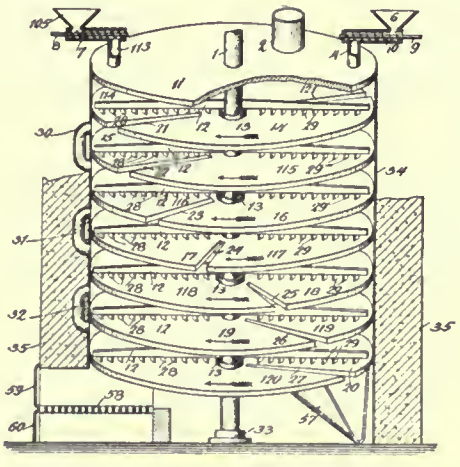


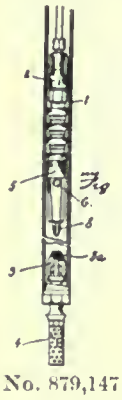
No. 879,842

A furnace for the reduction of zinc-bearing ores, having an elongated furnace body open at both ends, one open end serving for the admission of the ore and the other serving as an outlet for the solid products of the reduction, means for axially constricting the alined outlet of the furnace, means for feeding the material in the ore-chamber of the furnace from the receiving to the discharging end, and means for producing an electric arc in the ore-chamber, said chamber having in its walls fume-apertures disposed between the reduction point and the charging end of the furnace and extending from the ore-chamber obliquely outward and toward the receiving end of the chamber.

ROASTER.—No. 879,842; Walter G. Swart, Denver, Colorado.

A roaster having a hearth with a plurality of substantially radial slots extending inward from its periphery.

STAND-VALVE EXTRACTING MEANS FOR OIL-WELL PUMPS.—No. 879,147; Evelyn A. Copeland, Tionesta, Pennsylvania.



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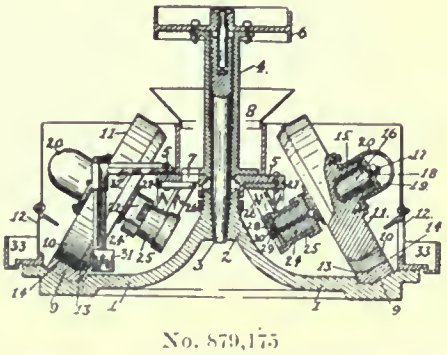


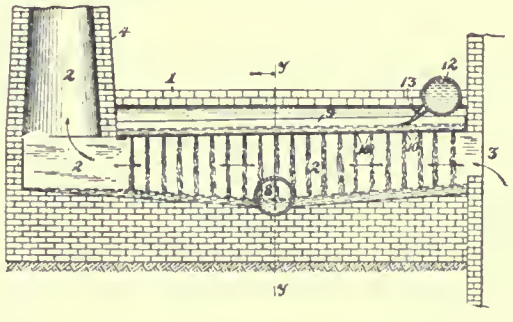
No. 879,175

In means of the class described, the combination with an oil-well pump including a plunger, and a stand-valve having a threaded portion at its upper end, of an attachment applied to the lower end of the plunger and consisting of a supporting member secured to the plunger, and an extracting member mounted for rotation with said supporting member but movable into a position in which it does not project from said supporting member, said extracting member having a threaded portion at its lower end for connection with that of the stand valve.

CRUSHING-MILL.—No. 879,175; Frank A. Huntington, San Francisco, California.

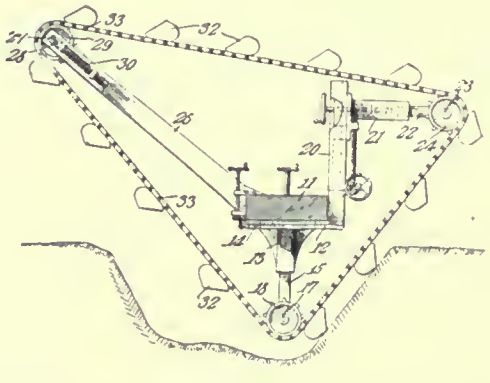
In a crushing-mill of the roller type the combination of a pan, screens in the pan-rim, a crushing roller in the pan inwardly inclined from the bottom upwardly, said roller having the inner side of its crushing surfaces inclined to its axis of rotation to form a straight horizontal portion at the bottom, and having the remainder of its crushing surface parallel with the axis of rotation to form a straight upwardly inclined outer portion; a ring die in the pan against which the crushing roller acts, said die having its crushing surface formed with a straight horizontal inner portion and a straight upwardly inclined outer portion, to correspond with the crushing surface of the roller and a driving means for effecting the orbital travel of the roller in the pan, said driving means including pivotal connections to enable the roller to swing centrifugally.

DEVICE FOR PURIFYING PRODUCTS OF COMBUSTION AND OXIDATION.—No. 879,149; Alexander A. Cunningham, San Francisco, California.



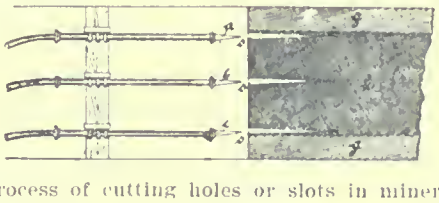
In a device of the character described, the combination of walls enclosing a purification chamber, means for causing the products of combustion and oxidation to pass through the purification chamber, a series of distributing troughs arranged in the upper portion of chamber, and provided with discharge openings, a supply pipe extending transversely across the distributing troughs, and provided with means for supplying the various troughs with a liquid, and means for discharging the liquid from the bottom of the chamber.

EXCAVATING-MACHINE.—No. 879,231; Frank M. Wrabek, Lesueur Center, Minnesota.



In a machine of the class described, a support, a plurality of sprocket-wheels, an endless belt excavator guided around said sprocket wheels, and bearings carrying said sprocket-wheels, each of said bearings being adjustable independent of each of the other bearings.

MINING PROCESS.—No. 878,208. Jacob Kirschniok, Zabrze, Germany.



The process of cutting holes or slots in minerals which consists in directing one or more fine jets of water under a very high pressure against the mineral in the direction the hole or cut is desired.

DURABILITY OF ELECTRICAL APPARATUS.

Electrical apparatus, when well constructed, is well nigh indestructible if subjected only to the ordinary amount of wear and tear, and often comes out with flying colors from the devastating effects of flood and fire. The few incidents quoted below are excellent examples of the amount of hard usage that well constructed electrical apparatus will survive in working condition.

In the Knights Deep mine near Johannesburg, Transvaal, there were installed thirty-six 15 k.w. transformers and twelve three-phase 50 hp. G. E. induction motors for operating the pumps. Through a peculiar combination of circumstances the mine was allowed to fill with water, the motors and transformers remaining under several hundred feet of water for over two years. When taken out, three of the motors were re-wound in the local repair shop. The others were simply dried out and then soaked in oil. Contrary to expectations and to the surprise of all concerned, the insulation was found to be in excellent condition, and the motors were put into service, apparently none the worse for their high-pressure bath. The transformers were treated in the same manner, and shortly afterward they replaced several transformers of English make, which had burned out only a short time after being installed.

A railway power-station situated near the Mississippi river experienced a severe flood during the season of high water. Two 1500 kw. 6000-volt generators were more than half under water for nearly a week, but when dried carried their load without giving any trouble whatever. In fact, the first machine to be dried carried the entire railway load until the second machine could be put into condition.

A three horse-power induction motor was taken from the ruins of the printing office of *The Democrat* at Ellsworth, Maine, some few days after the entire building had been destroyed by fire. After being freed from the protecting coat of ice and cinders, the motor was dried and cleaned. When connected to the circuit it ran as smoothly as when first installed. Some idea of the intensity of the heat to which the motor was subjected may be gained from the fact that the switchboard and instruments were completely destroyed.

A 20 hp. 550-volt three-phase induction-motor, installed in a leather warehouse at Salem, Mass., was subjected to a severe ordeal during a fire. After the building and its contents had been deluged with water, the motor was removed, and after being cleaned, dried, and fitted with another pulley, started immediately on application of the current. The motor has since carried its rated load, and does not appear to be damaged in any way except as to appearance. Another excellent example of the durability of the induction-motor was shown by the remarkable performance of a 5-hp. motor used in driving a pump in the G. H. Perry Co.'s quarry in South Dakota. The motor was often allowed to run without any attention over night, especially during the rainy season. One night a heavy rainstorm filled the quarry to such a height that the motor was half under water. When started the next morning, it picked up its load and carried it steadily until the pit was emptied of water. On examination it was found to be none the worse for its prolonged bath, although a new pulley had to be put in place of the old one, which was softened and warped out of shape.

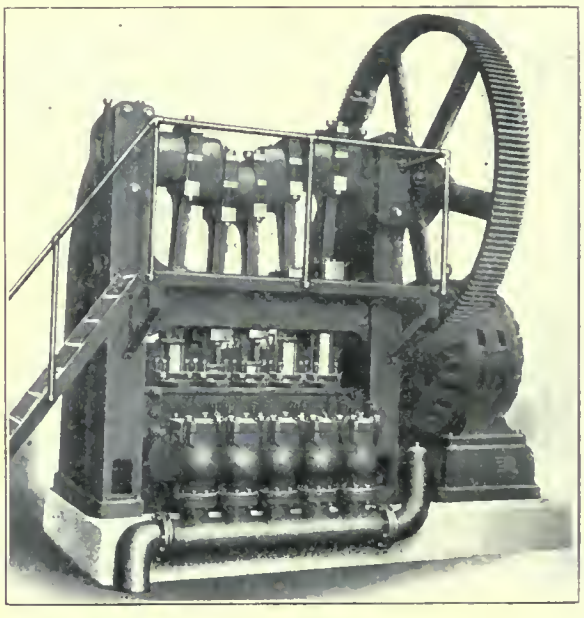
Several hundred General Electric flat-irons passed through the San Francisco fire, and aside from the fact that the wooden handle was destroyed and the iron slightly disfigured, the iron was as good as ever.

TRADE TREATISES.

The BALDWIN LOCOMOTIVE WORKS and the WESTINGHOUSE ELECTRIC & MFG. CO. have just issued a comprehensive catalogue of the electric locomotives for mine and industrial service manufactured jointly by these two concerns. The electric features of these well-known locomotives are the work of the Westinghouse Electric & Mfg. Co. and the mechanical features that of the Baldwin Locomotive Works. The numerous illustrations of typical installations show the extent to which locomotives of this make have been adopted. Among the illustrations is one of the testing plant in the Baldwin Locomotive Works, similar in construction to the highly successful testing plant in use at the St. Louis Exposition. This plant enables a complete record to be made of the performance of every locomotive before it leaves the works, thus determining positively just what may be expected of it under service conditions. Considerable space in the catalogue is devoted to the rating and performance of locomotives, and 'hour rating' and 'continuous capacity' are fully discussed. It is claimed that the Baldwin-Westinghouse locomotives are designed with particular reference to their 'continuous capacity,' experience having demonstrated that equipment thus rated is the least expensive for maintenance. The last two chapters are devoted to gathering locomotives and traction reel locomotives. The latter type is provided with a hooked steel cable, which winds about a vertical reel, driven by means of a small independent motor. A separate controller starts the reel-motor and the cars are hauled toward the locomotive, which itself remains stationary with brakes set.

ELECTRIC PUMP IN THE ANACONDA MINE.

An interesting electric pumping installation is being made by the Anaconda Copper Co. in its mines at Butte, Mont. The pump, which is illustrated herewith, is a 6 by 12 in. Aldrich vertical quintuplex type made by the Allentown Rolling Mills, Allentown, Pa., and is designed to deliver 425 gal. per min. against a head of 1100 ft. This pump is to be driven by a Westinghouse type CCL alternating current motor of 150 hp. capacity, at 450 r.p.m. The duty calls for heavy, substantial construction, and acid-



resisting material was required to be used in making the throat and plungers and other parts of the water end, on account of the bad condition of the mine-water that is to be handled. The use of five plungers operating from one crank-shaft, having connecting rods placed 72° apart, gives a uniform velocity of water in the pipes, thus adding greatly to the efficiency of the outfit.

The plungers are single-acting and outside packed. It is claimed that owing to the large size of the throats and valves and the comparatively low water-velocity through all the orifices, a high efficiency is obtained. This type of pump is becoming very popular in the Montana copper country by reason of its reliability and high efficiency, both of which are particularly important in mining operations, especially where power is purchased from transmission lines.

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Editorial.

METAL PRICES are improving steadily and general conditions in business are becoming more cheerful. Locally there is a renewal of activity among operators, notably in quicksilver mining in Napa county and in copper mining in Calaveras and Shasta counties. In Nevada there is plenty of life and the wild-cat is coming out of the enforced hibernation that followed the panic. But there is lots of gold in Nevada, and even the wild-cats cannot kill the real mining and the sane business that are bringing that State to a leading position as a gold region.

ANOTHER district soon to be the scene of a mining excitement is Golden Circle, 52 miles northeast from Goleonda and about 42 miles in a similar direction from Battle Mountain, Nevada. An automobile stage line leaves both places daily, and 1000 people are already on the ground. The making of booms is much better understood than the making of mines: the first counts confidently on the greed of humankind, plus a generous allowance for the adventurous spirit, while the latter is compelled to overcome all the obstacles of Nature, the chances of fortune, and the cussedness of things in general.

COMPRESSED AIR has become so important a form of motive power that any elucidation of the principles involved is bound to be interesting. And no one is better fitted to expound this subject than Mr. Edward A. Rix. It is 30 years since he and his partners, W. H. and John B. Reynolds, brought the Ingersoll drill to the aid of Adolf Sutro in the making of the great adit that drained the Comstock lode, and it is 30 years since Mr. Rix took the same drill to the Idaho mine at Grass Valley and replaced the old Burleigh machines, which weighed 600 pounds apiece, as against, say, 275 pounds for a drill of equal utility today. The Burleigh had just made a record in the Hoosac tunnel, a railway bore in Massachusetts, where this first machine-drill was invented about 1872.

CALIFORNIA is so celebrated for her treasures of gold that most people overlook her wealth of copper. Yet this State produces 32,000,000 pounds of copper per annum. Most of this comes from a cluster of mines in Shasta county, but some of it comes from the foothill country flanking the Sierra Nevada, especially in the counties of Fresno, Calaveras, and Amador. It is a region that is destined to become more productive as the coal deposits of the Pacific Coast become better developed and a varied smelting industry is firmly established. An understanding of the geological conditions surrounding the occurrence of these copper deposits is neces-

sary to anyone wanting to exploit them, and this gives point to the valuable article by our friend Mr. John A. Reid, a young geologist who has given much energy and intelligence to the investigation of this region.

Theories of Ore Deposition.

ANY EDITOR would be pleased to give his readers such a contribution as that of Mr. Horace V. Winchell, in which that experienced geologist discusses the theory of ore deposition presented lately by Mr. J. E. Spurr. The letter from Mr. Winchell bears the marks of a man who has been underground in a copper mine, and, having doffed his overalls, has found a comfortable chair in a library rich in books of reference. The kindly humor and the philosophic banter suggest the highly civilizing effects of an excellent cigar, and if not that, then a good nature such as not even my Lady Nicotine need pacify. Assuredly we wish that discussion of Mr. Winchell's kind were forthcoming every week. His criticism is penetrating but polite; it is scientific, yet humane. We hope that other geological friends will be prompted to take their part in a controversy so pleasantly begun.

In the meanwhile it behooves Mr. Spurr to sharpen his pencil or dip his pen in illuminating ink, to the end that some obvious contradictions may be explained and some dark places made light. It looks like the old story of a generalization that failed to cover creation, and, like a carpet made for a small house, it became a shriveled-looking covering for the floor of a mansion. The edifice of knowledge is growing continually; it becomes broader and wider as the base of fundamental fact is enlarged, and it becomes more lofty as the intelligence of man is enriched by investigation. And yet we confess to a liking for the enthusiasm that provokes a geologist to risk his generalization on the strength of new evidence. Such leaders of thought carry a light into the cross-cuts that penetrate into new ground, and even though a blast of cold criticism may occasionally blow out the torch of a suggestive theory, we are grateful to the torch-bearer who has pioneered the way and stimulated enquiry. To come to concrete examples: It is safe to say that the debates on ore deposition associated with the names of Emmons, Posepny, and Van Hise did an immense service in sharpening the observation of geologists and in kindling the intelligent curiosity of all of those who go down the mine in skips. Then there was the memorable discussion before the Geological Society of Washington, in 1903, when Messrs. W. H. Weed and J. E. Spurr submitted a new classification that elicited a vigorous exchange of ideas. Such give and take of opinion, when accompanied by submission of the facts each man has collected in the course of his work as a geologist or an engineer, have a greater value than the single utterance of an individual, however eminent or learned, and it is astonishing how these discussions have enlisted the interest of people engaged in mining. The value of geology has been brought home to the untechnical and the application of science to industry has been much emphasized.

Only ignorant people sneer at theories. An impregnable theory is as much an impossibility as an impregnable armor-plate. There never was an armor-plate but there was, sooner or later, a gun that could smash it; and there never was a theory so flawless that it survived, unchanged and unharmed, the buffeting of the waves of Time and the artillery of ascertained facts. The man that expects to say the last word on a scientific problem is possessed of a splendid conceit; the man that is willing to stimulate thought by launching a working hypothesis is a benefactor, for even if his mental vessel must finally be wrecked, before its cruise is ended it will have sailed into unknown seas and carried a freight of understanding from one shore to another. All of us are compelled to theorize on insufficient knowledge, for even the youngest is not infallible. Each man covers a small area of observation, and his theories express the trend of his thought, as a tangent represents the direction of a curve over a small arc. But the tangent leads away from the curve; so also the theory, if followed with more enthusiasm than judgment, is likely to carry the observer away from his facts. We strike new tangents to fresh curves; we formulate new theories on the strength of fresh facts, and thus we avoid rushing too far into the limbo of supposition. Theories come and go, but knowledge widens. On the stepping stones of dead theories the geologist climbs slowly to the high summits of his science; he climbs, but never reaches the topmost crest; range after range is surmounted only to show range upon range beyond.

Mining and Metallurgical Societies.—II.

AMONG the societies organized in the interest of those who are engaged in mining, the American Mining Congress has achieved some prominence. Before arriving at any conclusion as regards the need of a new association, it will be well to enquire what the Congress has done and what it may hope to do. Founded eleven years ago, the American Mining Congress has had plenty of time to settle down to its chosen work. It was started as the International Mining Congress, but neither the membership nor the performance ever warranted a title so comprehensive. At its baptism it expressed the flamboyant expectations of the founders, a small clique whose avowed purpose was to stimulate popular agitation in favor of a Department of Mines at Washington. Annual conventions have been held, and as financial support was difficult to obtain, an appeal was made to different mining centres, successively; these furnished money and a transitory enthusiasm, in return for which the locality was generously 'boomed' by speeches, mineral displays, and a brief prominence in the daily press. This went on for a few years: then financial irregularities and mismanagement brought the International Mining Congress to the verge of ruin, so that, six years ago, it was resuscitated as the American Min-

ing Congress. Then, under a new management, it obtained a fresh lease of life, more vigorous and more sane. Mr. James H. Richards, of Boise, became president, and his friends became directors. They were assisted by a few mining engineers and geologists, who increased the prestige of the Congress by reading some excellent papers on technical subjects. The attendance at the annual conventions was improved thereby. But the Congress continued to be a complex institution, in part political, in part social, but also industrial and technical, while to such manifold activities there was always tied, like a tin can to the tail of this hybrid organism, a recurrent noisy effort to boom this or that mining district. Mr. Richards, a lawyer of wide experience and high character, has held together the diverse forces that give momentum to the undertaking, and it is to him and a small group of optimists that the organization owes its vitality. While it is true that the Congress is in the hands of a coterie, it is fair to add that but for the efforts of these few men the Congress would not have survived, nor is it apparent today that any other group would be willing to do the same work so persistently. For the Congress has not won any such measure of general support as was expected. Why? In the answer to this question lies the value of this enquiry as it affects the plans for a new organization.

Taxation without representation once received a historic protest, but representation without taxation is hardly less opposed to the logic of human affairs. This fundamental principle is transgressed by the Congress. It has never had a representative membership and it has never been placed on a respectable financial basis, because it is not supported by its own members. The list published in the last report shows 400 names, but of these 165 members are credited to Colorado, and bespeak the support given to the convention held at Denver in 1906. Members paid $631 in dues, while $835 was received from entrance fees, indicating the insignificant income derived directly from the rank and file of the organization. On the other hand, the City of Denver donated $1000 and the Chamber of Commerce in the same city collected $3500 more. This simply proves, as is well known, that the Congress is dependent upon the financial aid of the community in which its annual convention happens to be held, and, in return, the business of that community profits by the attendance of delegates and members from other parts of the country. While delegates cannot vote on the internal affairs of the Congress, they can take part in the proceedings, and as a matter of fact it is to them that the Congress looks for entertainment. Usually the most exciting event of each annual session is the choice of the place of next meeting; this involves a general debate, led by one or two orators, followed by impassioned speeches that evoke great enthusiasm. At the Denver convention there were about 250 delegates, of whom 150 represented the State in which the convention met. These delegates are nominated by Governors, Mayors, Chambers of Commerce, and so forth; the nomination means nothing, and not 10 per cent of those selected ever signify the least intention of accepting the appointment or of attending the Congress. In 1904 the President of the United States appointed three delegates (of whom one attended the Portland meeting), and in 1905 he requested the Director of the Geological Survey to select a larger number; those chosen finally received a letter signed by the Chief Clerk of the Survey, so that the whole thing descended into a formal absurdity. Thus, both as to membership and delegation, the Mining Congress fails to be in the least representative. Therein lies its failure.

And yet it has not utterly failed, for the Congress has held forth in advocacy of a Federal Department of Mines, and it deserves credit for having finally prompted legislation on this subject. Yet it looks now as if all the effort made were to end in a mere enlargement of the technological branch of the Survey. This result is not devoid of humor. It is to the members of the Survey that the meetings of the Congress have owed much of their interest, for the Government geologists have read papers of more than local interest, and their addresses on the waste of natural resources, on mine accidents, and on kindred subjects, have given the conventions a national character and a dignity much needed. It has been obvious to the onlooker that the policy of the Director of the Survey has been to recognize the Congress and steer its course in matters affecting the welfare of the Survey. For its success the Director may be complimented; and this refers to both Mr. Charles D. Walcott and Mr. George Otis Smith. Now that the Mining Department question is practically shelved, the Mining Congress has lost one of the chief stimulants to its vitality, and is likely to devote itself to voicing the grievances of mine operators against the smelting corporations, to advocating measures for the prevention of fraud in mining, and to other subjects of public interest. But as long as it remains in the hands of a coterie of mixed character, as long as its membership is neither representative nor self-supporting, and as long as it is at the mercy of local 'boosters,' it will accomplish no useful purpose. To be a force in the country, the Congress must depend neither upon mine promoters nor hotel-keepers, and it must be shorn of its appendages, such as the reading of technical papers. The mixed audience that the Congress affords is not fitted for the consideration of technical questions; no useful scientific discussion is possible before a nondescript gathering, agitated by cross-currents of a political nature. Some excellent papers that ought to have appeared in the transactions of technical institutions, have been entombed amid the oratorical confectionery of Mr. Josephs of Utah or Mr. Lafe Pence of Colorado. As an organ of public opinion the Congress may have a useful function to perform, but as it is now constituted it suffers from numerous adhesions of a debilitating character. A surgical operation seems necessary, followed by adequate sustenance from a vigorous body of self-supporting membership. Whether it will survive such capital treatment may be doubted; it may prove one of those highly successful operations that please the surgeons while killing the patient, but it is also the only one likely to preserve his life.

Personal.

ALFRED JAMES is in Mexico.

W. J. LORING is expected in London.

JOHN B. FARISH is in Sonora, Mexico.

LEO VON ROSENBERG was at St. Louis lately.

HAROLD RICKARD is on his way to Guatemala.

R. S. RAINSFORD, of Salt Lake, is at New York.

JOHN R. FARRELL is now living in San Francisco.

P. R. BRADLEY is at New York, from British Guiana.

RUPERT C. ALABASTER is at Cloncurry, In Queensland.

M. PARRY GOSSET is now at Tominil, in Durango, Mexico.

R. STUART BROWNE has returned to San Francisco from Mexico.

CHARLES BUTTERS has returned to San Francisco, from Mexico.

DONALD FERGUSON, of Goldfield, Nevada, is here on a short holiday.

CHARLES L. TUTT, of Colorado Springs, is at the St. Francis hotel.

C. E. ARNOLD is working in the Hoatson shaft, at Bisbee, Arizona.

C. J. KENNEDY, of Seattle, was here on a visit from the Comstock.

JOHN A. PORTER has returned to Denver, from San Jose, California.

A. CHESTER BEATTY has been taking a few days holiday in Bermuda.

W. G. SCOTT, foreman with the Arizona Copper Co., is here from Morenci.

FRANK LAWRENCE has returned from Australia, on his way to Colorado.

H. W. HARDINGE has gone to southern Nevada and expects to visit Rawhide.

MARTIN J. HELLER has moved his office to 43 Exchange Place, New York.

WILLIAM DE L. BENEDICT is on his way back to New York, from San Francisco.

FREDERICK S. HARRIS is ill of typhoid fever at the Agnew Sanitarium, San Diego, California.

LOUIS JANIN came from his farm near Santa Barbara, and remained in San Francisco for a few days.

MARK R. LAMB, formerly with Charles Butters & Co., is now with the Moore Filter Co., of New York.

GEORGE A. SCHROTER, consulting engineer to the Creston Colorada Co., in Sonora, is now at Los Angeles.

FRANK A. KEITH has resigned as manager for the Tonopah Mining Co., owing to pressure of private business.

O. M. PUDOR, lately general manager for the Texas-Nevada Gold Mining Co., of Olinghouse, Nevada, has gone to Rawhide.

W. S. WARD has been appointed director of the department of art and minerals in the Colorado Museum of Natural History, at Denver.

P. T. FARNSWORTH has resigned as manager of the Horn Silver mine, in Utah. He has been succeeded by M. C. MORRIS, formerly assistant secretary of the company.

J. E. SPURR has gone to Matehnala, San Luis Potosi, Mexico, to make a geological examination of the Cobriza mine for its owners, the Compañia Metallurgica Nacional.

HOWARD P. SAUNDERS, of Salt Lake, is examining the Nevada Superior mines, at Humboldt, and then he will go to Cherry Creek, also in Nevada, to supervise the construction of the new stamp-mill of the Cocomongo Gold Mining Company.

DIVIDEND.

The Minas Pedrazzini Co., of San Francisco, has declared dividend No. 4 extra, payable April 1, and the regular No. 5 of 2½%, payable May 15.

Latest Market Reports.

LOCAL METAL PRICES—Mar. 19.

Antimony	12@16c	Quicksilver (flask)	$45@45.50
Casting Copper	14¼@15¼c	Spelter	6½@ 7¼c
Pig Lead	4.35@ 5.30c	Tin	31½@33c

ANGLO-AMERICAN SHARES.

Cabled from London.

	Mar. 12. £. s. d.	Mar. 19 £. s. d.
Camp Bird	0 13 0	0 13 3
El Oro	1 1 10½	1 1 3
Esperanza	1 1 3	1 3 9
Dolores	1 2 6	1 5 0
Oroville Dredging	0 11 3	0 11 6
Stratton's Independence	0 2 6	0 3 3
Tomboy	1 8 9	1 8 9

(By courtesy of W. P. Bonbright & Co., 24 Broad St., New York.)

MINING STOCK QUOTATIONS—NEW YORK.

	Closing prices. Mar. 12	Mar. 19.
Bingham Central	⅜	⅜
Boston Copper	14⅞	14⅜
Cumberland Ely	8	8⅛
El Rayo	1½	1⅜
Giroux Con.	3⅛	3¼
Guanajuato Con	2	2
Nevada Con	10¾	11½
Nipissing	6¾	6¾
Tennessee Copper	28½	32
United Copper	4⅜	4⅝
Utah Copper	26	26¼

(By courtesy of Hayden, Stone & Co., 25 Broad St., New York.)

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date	Electrolytic Copper	Lead	Spelter	Silver
Mar. 13	12.57	3.67	4.63	55¾
" 14	12.57	3.83	4.63	55½
" 15	Sunday.	No market.		
" 16	12.75	3.87	4.63	55⅞
" 17	12.87	3.87	4.63	55¼
" 18	12.87	3.93	4.68	55⅜
" 19	12.87	3.93	4.68	55½

SOUTHERN NEVADA STOCKS.

San Francisco, Mar. 18.

Atlanta	$ 25	Manhattan Con	16
Belmont	1.17½	Midway	59
Columbia Mtn	21	Mizpah Extension	06
Combination Fraction	74	Mohawk	.....
Daisy	1.25	Montana Tonopah	1.65
Fairview Eagle	60	Nevada Hills	2 85
Florence	4.10	Rawhide Queen	1.75
Gold Bar (Bullfrog)	25	Red Top	.....
Goldfield Con	4.97½	Sandstorm	27
Gold Kewanas	44	Silver Pick	25
Great Bend	45	St. Ives	35
Jim Butler	29	Tonopah Extension	96
Jumbo	.....	Tonopah of Nevada	5.85
Jumbo Extension	40	Tramp Con	16
Laguna	.....	West End	25

(By courtesy of W. C. Ralston, 353 Bush St.)

COPPER SHARES—BOSTON.

	Closing prices. Mar. 19.		Closing prices. Mar. 19.
Adventure	1½	Michigan	10
Ahmeek	.....	Mohawk	49
Allouez	25	Nevada Con	11½
Amalgamated	57	North Butte	53
Arcadian	3½	Old Dominion	37
Atlantic	10	Osceola	85
Bingham Con	.....	Parrot	17¼
Boston Con	14¼	Phœnix	50
Butte Coalition	.....	Quincy	.....
Calumet & Arizona	103	Rhode Island	3¼
Calumet & Hecla	625	Santa Fe	1¾
Centennial	23½	Shannon	11¼
Con. Mercur	.....	Superior & Pittsburg	12¾
Copper Range	63	Tamarack	60
Daly-West	8¼	Trinity	13¾
Franklin	7¾	United Copper com	5¼
Granby	88	Utah Copper	.....
Greene-Cananea, ctf	8⅝	Victoria	3
Isle Royale	.....	Winona	5½
Mass	2½	Wolverine	121

General Mining News.

ARIZONA.

COCHISE COUNTY.

The Maggie vein on United Globe ground has been struck in the north cross-cut from B shaft on the tenth level of the Old Dominion ground. Sulphide vein No. 1 was struck on the 15th level from the winze to the 16th. The Maggie vein was struck at a distance of 850 ft. from B shaft, and although the vein has been cut for only a few feet, the ore disclosed so far is of high grade. Sulphide vein No. 1 was struck on the 15th level, 95 ft. from the winze, and the full breast in the cross-cut is in ore. The grade of the ore is similar to that on the foot-wall of the vein on the 16th level running low in copper and high in sulphur. The diagonal cross-cut driven from the main cross-cut on the 5th level of the Great Eastern mine of the Superior & Boston to intersect the Black Hawk vein at a point 40 ft. west of where the vein was first struck, has now penetrated the vein, but has not yet cut through it. This proves up the Black Hawk vein for a length of 220 ft. on Great Eastern ground. The drift which is being driven from the Black Hawk mine along the vein is now 100 ft. into the Superior & Boston ground, with no apparent change in the character of the ore.——The first consignment of the new pumps to be installed on the 1000-ft. level of the Big Shaft of the Tombstone Con. Co., consisting of three car-loads, has arrived. The new pump will complete an installation of a daily capacity of 10,000,000 gal. The quantity of water at present raised is about half that amount.——At the Emerald mine satisfactory developments are being made. The winze that is being sunk from the 800-ft. level is in ore, the limits of which have not yet been determined.

GILA COUNTY.

The discovery of a low-grade copper deposit is reported from the district on the old Mineral Park Chloride wagon-road about ¾ mile from the Western Railway of Arizona. Carbonate of copper is found impregnating a breccia, but little development work has been done. The deposit is below the limestone on Nigger Head Mtn.——The labor troubles between the Warrior Copper Co. and the Globe miners' union have been settled.——The annual meeting of the stockholders of the Octave Mining Co. was recently held in Phoenix. The report showed the mine to be in excellent condition, with over 268,000 tons of ore blocked out, assaying about $8 per ton. As soon as the ore reserves justify enlargement, additional stamps will be erected and an electric power-plant installed.

GRAHAM COUNTY.

The New England & Clifton Copper Co., which recently resumed operations, is now making regular shipments of ore to the Shannon smelter. The double-compartment shaft at the Antietam has been straightened and will soon be completed. From the mines in the upper part of the district shipments are made daily over the tram-road recently built by the company. A new air-compressor has been shipped to the Antietam mine and shipments will soon be increased.——At the Copper King mine development is progressing well, and 25 tons of ore are shipped daily.——The New York-Arizona Co. will soon erect a 10-stamp mill, as sufficient milling ore is now blocked out to justify the expense.——Ore has been found in a cross-cut on the 1200-ft. level of the Gem shaft of the Globe Con. Co. A 2-ft. vein was encountered in the north cross-cut at 330 ft. from the shaft. The cross-cut will be continued 150 ft. farther, where it should encounter the Future vein. This vein was barren on the 500-ft. level, though well defined walls were found, between which vein-stuff 22 ft. wide occurred.——Rich ore has been found on the Iron Cap mine of the National Mining Exploration Co. Six feet of high-grade carbonate ore was found in the west drift on the 460-ft. level.

SANTA CRUZ COUNTY.

A 30-ton smelter will be erected at the Mansfield mine. J. A. Traylor, of the Traylor Machinery Co., is consulting engineer to the company.

YAVAPAI COUNTY.

W. A. Robinson and J. Kennedy, who have a lease on the Samoan mine at Chloride, have 37 tons of ore on the dump ready for shipment to the smelter.——The mill which is being erected by the Yucca Clanide Mining & Milling Co. near Cedar is nearly completed.——A stringer of rich ore has been found by J. H. Haas on his claim south of the Keystone, Mineral Park.——At the Bullwhacker mine, situated 3 miles east of Prescott, rich ore has been found on the 60-ft. level.

YUMA COUNTY.

At the Colonial Mining Co.'s plant in the Weaver mining district, near Ehrenburg, ore is now being run through the 36-ton quicksilver furnace. The ore is broken down in the stopes, sorted and run into mill-holes, the waste from the mine being used for filling. From chutes at the bottom of the mill-holes the ore is trammed to shaft-pockets, from

Map of Arizona.

which a self-dumping skip is filled, hoisted to the top of a head-frame, and dumped over a grizzly, the fines falling into a 100-ton bin, the coarse going to a crusher, after which it goes, together with the fines, to the furnace bin.

CALIFORNIA.

EL DORADO COUNTY.

At the Woodside-Eureka mines, the work of grading for the foundations of the head-frame and hoisting-engine at the old Eureka shaft will be begun shortly. The old shaft is 240-ft. deep. One of the new 60-hp. boilers and hoisting-engines will be moved from the new 3-compartment shaft 600 ft. south, to the old shaft, and after unwatering the old workings, several hundred tons of the ore now exposed in the lower workings will be extracted, and development carried down to 70 ft. below the present lowest level.——It is reported that a shoot of high-grade ore has been found on patented land, between the Taylor and the Argonaut mines, on the Collins ranch.——Sinking has been resumed at the Little Chief mine and a pump has been installed.——Lumber is being hauled to the Gilbert mine for surface improvements, and development work is progressing.——The Green Valley Mining Co., which is operating on a gold-bearing channel in the Dormody ranch, has installed an elevator, actuated by a gasoline engine. This supplies water under pressure to run the gravel down from 8 to 15 ft. into sluices.——At the Clipper mine in the Georgetown district, preparations are under way to commence sinking the shaft to the 500-ft. level.——At the Collins-Bacchi mine

work will soon be commenced on the new shaft.——At Craddock's mine in the Canyon, the cross-cut adit has struck the Smith and Kohn vein. Drifting will now be begun both ways.

NEVADA COUNTY.

(Special Correspondence).—The adit at the Posey Canyon has reached a point below the channel. A raise is being driven to tap the gravel.——The shaft at the Bessie mine is down 200 ft. in ore. Considerable ore is on the dump and the company is arranging for the installation of a stamp-mill. Byron Burgiss is superintendent.——A good body of ore has been struck in the south drift in the Gold Mound mine at a depth of 150 ft. An 8-ft. vein of good grade milling ore is being developed. The shaft will be sunk to a depth of 800 ft. as rapidly as conditions permit. Howard P. Dennis is superintendent.——The Kenosha shaft is rapidly going down. High-grade ore continues to come from the vicinity of the 300 level.——Extensive development work is under way in the lower workings of the North Star mines. Eighty stamps are constantly falling on good ore.——Work has been abandoned at the old Malakoff mine and the track and underground supplies removed.——Owing to deep snows at the scene of operations, the Anchu mine has suspended work until warm weather sets in.—— The orebody recently encountered in the west drift on the 1000-ft. level in the Murchie mine continues to show well with development. Preliminary work on the sinking of the shaft 200 ft. will commence at an early date.——At the Oustomah considerable exploration and development work is going on. Good ore has been blocked out at several points.——Promising bodies of ore are being developed in the Golden Gate. Much of the ore is high grade. W. P. Martin and associates are working the mine under a lease. ——Robert Johnson has developed the antimony vein on his ranch for a considerable distance. Tests of the ore show good percentages of antimony, with small quantities of other valuable metals.——The shaft at the Normandie is going down steadily, and it is expected that the main veins will soon be intersected. Several men are employed. ——Bray Wilkins states that his company is prepared to work the Idaho-Maryland mine on a large scale. The rich vein recently encountered on the 500 level continues to show splendidly. Ten stamps are running on ore coming from this vein.——Several claims have been recently located in the Bloomfield district and notices filed with the County Recorder.——Reports continue to be circulated to the effect that work at the Conlan mine will soon start.—— The two veins under development in the Union Hill are showing well. A fair tonnage of ore has been blocked out. ——Representatives of Eastern mining interests have been examining properties in the Grass Valley-Nevada City district with a view to their acquisition.——Local mine operators are said to be heavily interested in the company which recently purchased the Mason and adjoining ranches, below the city, for mining purposes.

Grass Valley, March 16.

PLACER COUNTY.

The water has been pumped out of the Mountain Gate mine and gravel is being extracted. The ground will be worked through the Hidden Treasure adit.——The Homestake mine at Last Chance is being operated by R. L. Fletcher. A mill will be erected as soon as the snow is off. Much of the gravel is cemented and requires milling, but it is of good grade. The Slope, Wasson, and Blackhawk mines will also be worked under the same management through the Paragon adit.

SHASTA COUNTY.

The improvements at the Kennett smelter of the Mammoth Copper Co. have been nearly finished, and the two new blast-furnaces and two converter-stands are now in operation. The blast-furnaces are 50 by 180 in., with water-jacketed tops and settlers of 16 ft. diam. and an intermittent tap. About 1300 tons of crude ore will be treated and the matte re-melted in a blast-furnace before it passes to the converters. The new converter building has two converter stands and eight shells, 96 by 150 in. The converter building is served by two Morgan electric overhead cranes of 50-ft. span and a main hoist of 50 tons capacity, with two subsidiary hoists of 15 tons each. In the power-house four Connersville blowers have been added, and also a converter blowing engine of 10,000 cu. ft. capacity at 15 lb. per sq. in., driven by a 750-hp. G. E. motor. A relining plant for the converters is equipped with two pneumatic tapping machines of the Ingersoll-Rand pattern. A new dust-chamber and steel stack 200 ft. high and 18 ft. diam. has been erected for the blast furnaces, and the old one will be used for the converter plant.

COLORADO.

CLEAR CREEK COUNTY.

Work will soon be resumed on the old Georgetown adit, the portal of which is on Columbia Mtn., by the Georgetown Mining, Power & Tunnel Co. It is the intention of this company to drive the adit 6000 ft. and tap the mines in Democrat Mtn. The adit will be 8 by 8 ft. in the clear. ——The Charter-Raton Mining & Milling Co. is driving the La Moe tunnel on Breckenridge Mtn. The tunnel has been advanced 950 ft.——A rich streak of ore from 6 to 10 in. wide has been found in the Sporting Times mine on Griffith and Alpine Mtn.——The machinery at the Mendota mill, being operated by the Mendota Mines Co., has been started up after repairs. Three shifts will be worked and lead, zinc, and iron concentrates will be shipped. The plant will treat dumps and some ore left in the old stopes above the Victoria tunnel level. The mill has a capacity of 25 tons per day.——The Shively cross-cut adit is being driven with Temple electric drills. This will cut the Shively shaft at the 500-ft. station.——Rich shoots of ore have recently been found at the Capital mine. In the west drift on the Aetna vein a rich orebody has been found, but its size has not yet been determined. The 100-ton mill is running steadily, and a night shift will soon be put on.

GUNNISON COUNTY.

Richards & Co., who recently took a lease and bond on the War Dance and War Dance extension claims in lower Willis gulch in the Russell district, have struck high-grade ore in driving at a depth of 140 ft. Lessees have taken out several tons and expect to make a record shipment to the sampling works. The strike was made on the War Dance, which is down a depth of 140 ft.——It is reported that a discovery has been made in the Jumbo adit, situated on the east side of Jenny Lind gulch and near Boulder Park. The adit is now in a distance of 700 ft., and the vein just opened is reported to be 20 ft. wide.——The Champion Mining & Milling Co., operating in the Phoenix district, is getting out some ore at its Lone Star mine, where work is being done at a depth of about 250 ft. The company is arranging for the deepening of the shaft.——The work of unwatering the Paoli mine in Leavenworth gulch is progressing favorably, the water now being down below the first level, where they have some good ore. The main shaft is down 220 ft., and as soon as unwatered and re-timbered wherever necessary, the lessees will sink as well as carry on considerable drifting work. Machinery has been installed and the surface buildings are to be painted.——A shipment of 30 tons of smelting ore was made from the upper workings of the Two-Forty property in Willis gulch recently to the Argo smelter, which gave returns of about $20 per ton. The property is being worked by lessees.

SAN JUAN COUNTY.

The Auburn Con. Mining Co. will start active development as soon as the weather improves. A new 25 kw. transformer will be installed for use with the Temple electric drills, and a new mill will be commenced as soon as the adit reaches the vein.——Ten men are steadily engaged in driving the tunnel on the Bullion King mine. High-grade ore has recently been found.——At the San Antonio mine at Red Mountain work will soon be actively resumed, and a deep level adit commenced. This will be started near the Junction, and will cut the veins at a depth of 600 ft. when 3150 ft. in length. The adit on the Camp Robber group will also be extended to the orebodies, which will

cut them at 250 ft. below the surface, and the Salem adit will be driven 600 ft. forward to open up unexplored ground. At the Carbon Lake mine the shaft will be unwatered and sinking will be resumed. At present the shaft is only 200 ft. deep, and there is less than 500 ft. of drifting and cross-cutting. The ore formerly mined averaged $21 per ton.

TELLER COUNTY.

Active development work is progressing on the property of the Michorado Gold Mining Co. on Iron Clad hill. On the Seven-Thirty claim, adjoining the Forest Queen, a contract has been let for the sinking of the shaft to the 250-ft. level. The shaft is now at a depth of 190 ft. and several stringers of good ore have been encountered. A station will be cut at the 200-ft. level and a drift started on the vein.——The Summit claim, owned by this company, situated near the Ironclad mill, is leased to G. E. Walcott for two years. A shaft, 8 by 8 in the clear, is being sunk, and is now 30 ft. deep.——The Pride of Cripple Creek Leasing Co., operating on Iron Clad hill, has shipped a car-load of $25 ore, which was stoped from a 3-ft. vein on the 560-ft. level.——The Little Ciara Leasing Co., operating on the south end of the Little Ciara through the Ophelia tunnel, is reported to have worked the main No. 45 vein up to the side line of the Lucky Corner claim of the Doctor-Jack Pot Co. The same parties, the Humphreys-Thompson lease partnership, are also reported to be sinking the shaft on the Callie claim of the Stratton estate. This shaft, now 675 ft. deep, is reported entering another flat formation, the assays taken taken from the vein recently disclosed being low. With an additional depth of 25 ft., cross-cuts are to be carried east into the Little Ciara and west into the Morning Glory No. 4. On the middle block of the Little Ciara, under lease to the Union Leasing Co., development work is in progress, but shipping ore has not been encountered to date. The Work company directorate at its last meeting in February declared a dividend of $15,000 and the distribution will be made on April 4. The company has paid to date $165,000.

A petition was filed in the district Court yesterday by the Franklin Mining Co., asking for a writ of injunction to restrain the Gold Sovereign Mining & Tunnel Co. from interfering with the shipment of ore by the plaintiff. It is alleged in the complaint that the defendant company is seeking to coerce the plaintiff to ship its ore to the United States Reduction & Refining Co., in spite of the contract existing to ship it to the Golden Cycle Co. It sets forth that on Dec. 19, 1907, the defendant leased to Albert Lewin the property known as the Gold Sovereign and James G. Blaine lode mining claims, survey 8600, and the same day Lewin assigned the lease to the plaintiff for three years. It is alleged that an understanding existed with the defendant that all ore should be shipped to the Golden Cycle Co., and that a contract for three years was made with such company. Now it is charged that the defendant wants the ore shipped to the United States Reduction & Refining Co., claiming it has made some agreement with this company. Plaintiff insists that it is a trick to cause plaintiff to violate its contract, so that the lease can be declared forfeited. It is further charged that the defendant has issued orders to the railroads to ship all ore from the mines to the United States Reduction & Refining Co., and that the railroads are holding the ore, at great loss to the plaintiff, pending court action. A writ of injunction is asked and also damages. An interesting feature in connection with the litigation between the Franklin and the Gold Sovereign companies is the fact that there are now 11 cars of ore tied up because of having been ordered to different mills by the rival litigants. While the disposition of this ore is awaiting settlement by the courts the railroads are charging $2 a day demurrage on each car.

Lessees on the Sitting Bull claim of the Keystone Mining & Milling Co., situated on Bull hill, have shipped four carloads of ore assaying $30 per ton. A vein 3 ft. wide has been opened up and drifting on the ore is now in progress at an approximate depth of 300 ft.——The Columbia Mining & Leasing Co., operating on the Chicken Hawk claim of the Katinka company, has more ore extracted than can be shipped with the present facilities. The ore assays $25 per ton, and a good sized body has been found on the 700-ft. level. The company is also doing some development work by extending the cross-cuts to the north and west to cut veins which are believed to traverse the property, as they have been explored on the adjoining Doctor-Jack Pot claim.

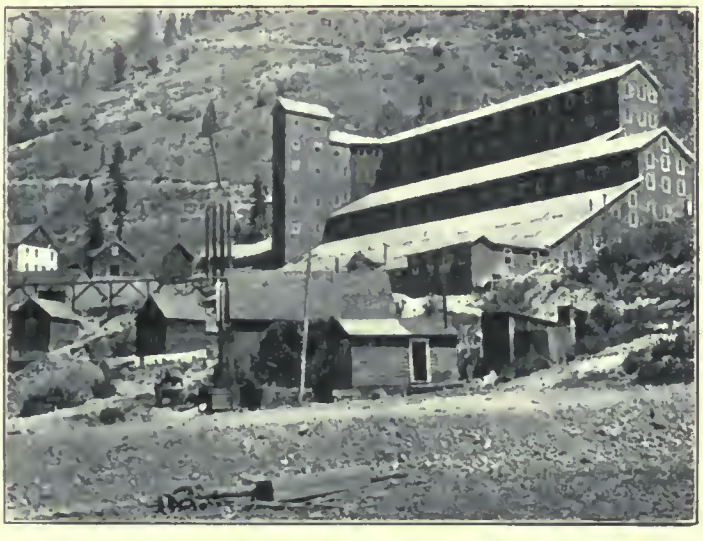
IDAHO.

IDAHO COUNTY.

The work on the 300-ft. station of the Buster mine has been completed and sinking resumed. About 30 men are employed and the mill was completed in December.

LATAH COUNTY.

(Special Correspondence).—Much activity is anticipated in the Hoodoo district during the coming season. The last consignment of machinery for the Mountain Gulch Mining Co. has arrived at Harvard, and as soon as snow has melted sufficiently, it will be taken to the mines. Millwrights will be sent to put in foundations, etc., within a short time. A two-stamp mill is already on the property, and a Huntington mill is among the new machinery added this season. ——The Mizpah Copper Mining Co. will begin development at once by raising from the No. 3 adit to a 50-ft. shaft, which will open up 200 ft. of ore. This ore is cuprite, malachite, and azurite, and is of high grade. It is said that with the completion of this raise the company will be ready to ship ore. Estimates have been received for an aerial tramway 200 ft. in length to the railway. The Washington, Idaho, & Montana railway has graded to within this distance of the mine, and has given assurance that as soon as a sufficient tonnage is secured, track-laying will be started.



Smuggler-Union Mill Near Telluride, Colorado

Spokane, March 4.

NEZ PERCE COUNTY.

(Special Correspondence).—The Orogrande Placer Mining Co. has been incorporated in Spokane by a number of Idaho and Washington men, and will begin working the rich gravel deposits of the Pierce City district as soon as the snow is off this spring. The incorporators are: W. H. Stole, W. S. Willis, W. O. Jones, R. D. Cleek, C. E. Horton, H. T. Madgwick, and Bedford Brown. The territory to be worked consists of 12 claims in the Orogrande creek bottoms, near the mouth of Rhoades creek. The ground is composed of boulders and fine sand, over which a growth of willows has spread. It will be worked by a Rubel elevator. A machine of this type operated for the past two

years by J. H. Porter has given excellent results, and it is said that ground carrying ten cents in gold can be profitably worked. The work of clearing the land and digging the ditch will be commenced by R. D. Cleek as soon as possible, and it is hoped to be washing gravel by August.——The Ozark Mining & Milling Co. has bought an air-compressor, power-drills, etc., and will erect them at the Wild Rose adit at once. This is the first power machinery ever taken into the Pierce City district. The company has been carrying on development work all the winter, but will now increase its force. Work is being concentrated on the 1200-ft. tunnel, which is to cross-cut the main lode, and the Ozark group is lying idle. From surface indications it is thought there are several smaller parallel veins which will be cut by the tunnel. Work has now progressed 150 ft.——A number of other companies are preparing for spring work, and within a short time dredges and elevators will begin.

Spokane, March 14.

SHOSHONE COUNTY.

The Snowstorm mine is shipping 100 tons of ore per day, and an increased output will soon be made. The ore is shipped to Tacoma, and the Granby smelters at Grand Forks and Great Falls. The Leslie mine has been unable to run its compressor, owing to the snow, which is 11 ft. deep. The water to run the machinery is now collecting in the reservoir, and operations will soon be resumed. About 6600 ft. of development work has been done, and it is expected that the vein will be struck by driving 50 ft. farther at a depth of 1100 ft. below the outcrop.——A tunnel is being driven on the Buffalo mine by contract. The tunnel is to be 1300 ft. long and will strike the main vein at 900 ft. and at a depth of 700 ft. When the vein is struck drifting will begin both ways.——The Rex mine is shipping ore regularly, the lead concentrate being sent to the smelter at East Helena, and the zinc product being stored until the market improves.

NEVADA.

ELKO COUNTY.

Gold Circle is about 35 miles from Battle Mtn. and about 47 miles from Golconda. It can be reached by automobile from either point, although it is handier now from Golconda, whence one may travel to the camp in three and a half hours. At present a road is being surveyed from Battle Mountain, and six regular autos and two stage lines are running form Golconda.——There are two town-sites, Midas and Summit, about a mile distant, which have been consolidated within the past few days under the direction of one corporation. At present the camp contains approximately 300 inhabitants, with newcomers arriving at the rate of 25 to 30 per day. Since the first discovery, which was made on the Bamberger claim some time in September last, little work has been done on account of snow, but with its disappearance, conditions are rapidly improving. Natural conditions are good, water being right on the ground in Midas, and water rights have been taken up in Summit, where the stream is said to be capable of generating nearly 1000 hp. for electrical power. The Bamberger strike, within 10 ft. of the surface, is perhaps the best yet uncovered. The Spotted Dog claim is also good, and the Esmeralda, four miles distant, shows the extent of the good territory. The Elko Prince has an adit driven in a distance of 100 ft. and is in good ore, while the St. Paul shaft is down 40 ft. The best ore is a very close-grained rock caller jasper, in which it is impossible to see free gold, but which pans most satisfactorily. At Golconda the hotel accommodations are good. All trains except the Limited stop there, and transportation is an easy matter.

ESMERALDA COUNTY.

A vein has been discovered on the 1250-ft. level of the North Star mine, which is more than six feet in width. The ore was found in a cross-cut 560 ft. north of the shaft, and is similar to that in the other important mines of the camp. This discovery is as deep as any workings at Tonopah, and would correspond to a depth of 1000 ft. below the collar of the Montana-Tonopah mine.——A 44-hp. hoist has been ordered by the Buckeye-Tonopah Mining Co., and sinking resumed. The shaft is now 275 ft. in depth. Four machine-drills and a compressor will also be installed.

A new find is reported at Lorena, a camp situated 18 miles southwest of Rawhide, on the road from Mina. High-grade ore is said to occur, and a boom has been started.——The control of the Combination Fraction is supposed to have passed to Goldfield Con. interests. The property is being worked and three car-loads a week averaging $70 per ton are being shipped. Daisy is developing excellent ore. The work is being done in shaft No. 1, and a raise is being driven from the 210-ft. level on ore that assays over $100 per ton. In addition to 3 ft. of shipping ore, a wide vein of milling ore occurs. The material for the Consolidated mill is arriving, and it is hoped that the construction will be finished by Sept. 1.

HUMBOLDT COUNTY.

(Special Correspondence).—A 10-stamp mill is to be built at the Mazuma Hill mine in Seven Troughs district. J. Hill of Lovelock is managing the property. He states that the ore is free-milling and most of the gold will be saved on the plates, though concentrating tables will also be erected. The machinery will be operated by a gasoline engine. The mine is opened by adits and by a shaft that was sunk from the lowest level.——The Kindergarten M. Co. is erecting a 10-stamp mill in Seven Troughs, which will be run by a gasoline engine. L. A. Friedman and J. Knight of Utah are interested in this property.——The Nevada United Mines Co., managed by J. T. Read, has been developing a prospect for some time in East range, 30 miles southeast of Lovelock. For the purpose of cutting a well known copper lode at about 1000 ft. depth, a long cross-cut is being driven. It is now in 1500 ft. and the lode will be intersected at approximately 2100 ft. from the portal. The cross-cutting is being done with air-drills, the compressor being steam-driven.——The Chase-Andrews Co. of New York is erecting a 100-ton concentrator four miles from Lovelock to handle the antimonial ores from the mine of the American Antimony Co., situated 14 miles from Lovelock. This mine is well developed to a depth of 400 ft. The mill is to be equipped with jigs, and is situated on the Humboldt river.——The mine and mill of the Bonanza King M. Co., which have been idle some time, are expected to resume operations this spring. The ore there carries gold and silver, and the mill has 15 stamps and four tables. The property is 30 miles out of Lovelock.——The Jessup district is described by J. T. Nagel as being 30 miles southwest of Lovelock, in a country of porphyry and rhyolite. Jessup peak, a landmark of that section, rises to an altitude of 7500 ft., the surrounding plateau being at an elevation of 3500 ft. The first discoveries of gold were made by Jessup and Murray last January in the lower hills of the plateau. The ore is in quartz veins, accompanied by talc. Some of the veins are at the contact of phonolite and porphyry. Mr. Nenzel, who lives in the district, states that considerable work is in progress by lessees.

Lovelock, March 14.

LINCOLN COUNTY.

One of the most important developments in this district for some time is the beginning of operations on the 5000-ft. tunnel from the Day mine, of the Nevada-Utah Co., through the mountain to the Bristol side. By means of this tunnel a highly mineralized district on the other side of the mountain is made accessible. There are several properties of promise in addition to the Bristol mine which will be affected. It is understood that the Bristol property has been taken over by the Nevada-Utah interests.——In the Columbus-Pioche, situated near the Half Moon, about 2½ miles from the town, has recently been opened a large body of silver-manganese ore similar in character to that of the Black Prince mine. The vein has been stripped for 60 ft., and on account of its desirable fluxing quality is a body of unusual promise.——The Ploche-Demijohn Co., while sinking its shaft recently, encountered a body of rich ore.——The Lincoln-Nevada Co. is below the 200-ft. level with its shaft. A station is being cut at the 200 level, where a 12-ft. vein of ore exists. Preparations are being made to stope

and ship ore, some of which is said to be of high grade. The shaft has been in ore all the way down.——The California-Pioche Con. Mining Co., which owns four claims adjoining the Ohio-Kentucky and Nevada-Utah, has just erected a 40-ft. head-frame, and is sinking a two-compartment shaft to develop its property, which contains an extension of the vein that the Ohio-Kentucky is working. This vein has every appearance of being of value, and can be traced from the Ohio-Kentucky lines almost a claim length. It is the intention of the company to sink 300 ft. and cross-cut to the vein.——The Prince Con. mine is opening up well under the vigorous development campaign being carried on there.

NYE COUNTY.

A rich stringer has been found on the Riggs-Forman lease on the Earl ground, on Litigation hill. The high-grade ore is being sacked from a streak about four inches wide on the side of a vein from one to three feet wide.——A mill will be erected to treat the ores from the Solid Gold lease on the property of the Round Mountain Daisy mine. The vein is 5 ft. wide and assays about $25 per ton.——The M. & M. lease is stoping ore, which will be treated in the custom mill at Round Mountain as soon as it is completed. A raise from the 90-ft. level has penetrated a vein 4½ ft. wide for 20 ft. A cross-cut on the 140 level has struck a new vein north of the main shaft, averaging $12 per ton. ——The Atchison Leasing Co. on the Round Mountain Combination has been sinking in ore from the surface. The shaft is now down 35 ft. A gasoline hoist will soon be installed.

STOREY COUNTY.

(Special Correspondence).—The Selby Con. M. & M. Co., managed by Emerson Gee of Reno, has performed 1000 ft. of work on its property three miles from Virginia City. The ore carries gold, and the company announces that a mill will be erected within the next few months.

Virginia City, March 16.

WASHINGTON.

FERRY COUNTY.

(Special Correspondence).—The Black Tail group of four claims, lying contiguous to the Lone Pine group, which the Syndicated Deep Mines Co. is working, has been taken on a working bond by J. E. McFarland, and will probably be operated in conjunction with the latter. A crew of men will be put to work shortly. The Black Tail group was a shipper in the early days of the Republic camp, when it sent 377 tons to the Granby smelter which averaged $18 in gold and silver. Another lot, put through the old Republic mill, ran about $14 to the ton. Since the collapse of the Republic mill this property has lain idle. This is the third group to become active within the last three months, and seems to indicate that the Republic district is to become a mining centre again. The Lone Pine has shipped two cars of ore, stoping having been begun about three weeks ago.

Spokane, March 13.

SNOHOMISH COUNTY.

At the Index-Bornite mine a 4-ft. vein with a pay-streak of rich copper ore has been found in the lowest adit. Driving on the vein has proved the vein for 34 ft. A shaft 70 ft. deep was formerly sunk on the vein and some rich copper ore obtained, but the present workings have developed the vein at greater depth. This property is three miles up the river from Index, and will be within half a mile of the proposed Index-Trout Creek railroad.——Development work is progressing on the Tillicum claims. An open cut has been made on the vein about 500 yd. from the county road, and copper and molybdenite ores discovered. The claims are now to be developed by an adit driven on the vein, which is now 125 ft. in length. This must be driven 75 ft. farther before the old workings will be reached.

CANADA.

BRITISH COLUMBIA.

(Special Correspondence).—Rumors of a gold strike of importance in the Le Roi mine, near Rossland, were confirmed March 11 by Andrew Larson, the superintendent, who admitted that a rich find had been made. The ore was found at the 1650-ft. level, where a cross-cut had been run from the main lode to tap the south lode. The gold runs from $5 to $40, and small shoots have gone as high as 5 oz. This is considered to prove the south lode in depth, which had been worked out above the 900-ft. level. A diamond-drill hole driven on the 900-ft. level a distance of 800 ft. to tap this same lode to the east, led to the driving of a cross-cut tunnel, which is now also in high-grade ore. This seems to prove the eastward extension of the south lode, which had been found barren as stoping progressed east. There have been no smelter returns as yet on this gold ore, as the company will ship it separately from the regular output.

Rossland, March 13.

(Special Correspondence).—The shipments of silver ore from the Cobalt camp last week were: Nipissing, 64.35 tons; La Rose, 45.09; O'Brien, 32.55; Coniagas, 30.94; Kerr Lake, 33.085; Temiskaming & Hudson Bay, 30; Silver Queen, 26.85; Nova Scotia, 20; Cobalt Central, 24.7 tons. The latter shipment consisted of a car of concentrates. According to the returns of the Dominion Government, the total silver production of Canada for 1907 amounted to 12,750,044 oz. of refined silver, valued at $8,000,000, of which the Cobalt camp produced about $6,500,000. It is estimated that this production will be doubled in the present year, as several of the big properties, among which is Cobalt Central, have only begun shipping regularly since the first of the year.——As the result of diamond-drill tests, the Silver Queen has decided to continue its main shaft to a depth of 400 ft. The Cobalt Central mines are also rapidly deepening their main shaft on the Big Pete property. The lowest level in the mine has now reached a depth of 240 ft., where four veins have been opened up. Within the last week another new vein, known as No. 5, has been cut on this property at the lowest level. On Lot 38, across the lake from the Big Pete, a new vein has been uncovered on the surface which closely resembles the rich No. 2 vein on the latter property. The Kerr Lake Crown Reserve's new vein is considered as rich as the Bonanza 49 on the Nipissing, or possibly richer, but not so wide. The vein is 25 in. wide, with large slabs of native silver standing up perpendicularly.

Cobalt, March 12.

MEXICO.

SONORA.

The Mejia Mining Co., which is operating a great antigua at Las Planchas de Plata, from which mine the company takes its name, has ordered a Merrill mill from San Francisco, whence the machinery is coming by steamer to Guaymas. As soon as the machinery reaches its destination it will be assembled and put in operation.

The Tribine Mining Co. has let a contract to the Arizona & Sonora Mfg. Co. for the erection of a reduction plant on its property in the Magdalena district beyond the Santo Domingo river. It will include a 20-stamp mill, power plant, and cyanide plant. Work will be commenced immediately, and the plant is to be completed and in operation by the first of September. At the mine development continues most satisfactorily, and it is reported that there is in sight sufficient ore to run the mill two years or more. A mill-run of 30 tons made recently in the Tucabe mill produced results that are reported as quite satisfactory.

COAHUILA.

The final payment of $220,000 has been made for the Boca del Cobre mine, 40 miles from Pedricena. In October, 1906, the property was bonded, and since December, when active development was commenced, the ore shipped to the Torreon smelter has produced $171,000 net. The company has now decided to develop the mine more actively, and a large shipment of machinery has been made from Denver. This consignment includes a 12-drill compressor and drills, two winze hoisting engines, an electric plant and a large quantity of tools.——The Purissima mine, near Bermejillo, has been bonded by local operators, and active development will be started.

Special Correspondence.

MEXICO.

Cyanidation at Pachuca.—Old Mills Change.—New Plants.—A Drainage Adit.—News From El Oro.

Following close upon the success which has been met by all in the old camp of Guanajuato in the use of the cyanide process for the treatment of its ores, comes now the almost full adoption of the same at the quite as famous old camp of Pachuca, which for over four hundred years has been a remarkable producer of the precious white metal. And even the name itself, Pachuca, which is said to mean, in Aztec, the 'City of Sighs,' is, according to traditions handed down from that race, derived from the result of a great battle fought by them to maintain the possession of their mines above the settlement; Pachuca being, as it were, on the road to Real del Monte, 1000 ft. above. The Spaniards finally obtained control, however, and here in 1557 the patio process was discovered and introduced by Bartolomé de Medina. Though these Spaniards practically abandoned their workings as soon as water was encountered and took up new ground, still for the treatment of all the ores there was no change from the patio process until the smelters came into Mexico, when the higher grade ores went there for treatment. But the medium and low grades were still treated on the patio until the purchase of the Real del Monte mines by the United States M. S. & R. Co., and their experiments proved conclusively the adaptability of the cyanide process in the treatment of Pachuca ores, and the company immediately began the erection of two 180-ton plants. But to the old Hacienda of San Francisco belongs the title of pioneer in the cyanide process in Pachuca, for, after an idleness of practically six years, it was quietly changed over and began using the cyanide treatment last year. It was soon followed by the Medina and then La Union. Now the United States M. S. & R. Co. has finished its two mills, the Loreto and the Guerrero, and will probably have them both in full operation before the end of April. The San Diego, which has been idle for two years, has resumed operation with concentration and cyanide. The Guadalupe of the Santa Gertrudis will probably soon be turned over to the cyanide treatment. The Amalgamated M. & M. Co., operating El Chico, and the Hidalgo Copper M. & S. Co., operating at Zimapan, both under the control of the Ludlow Bros., will use cyanide on such ores as are suited. And thus in this old camp, the birthplace of the patio, the time-honored Mexican process will soon be a thing of the past. But almost of as much interest and importance to the camp as the introduction of the cyanide process is the work being done by Gabriel Mancera of Mexico City. This is the drainage adit of Pachuca, which was started in a small way some 15 years ago, with the primary object of draining Atotonilco, El Chico, and adjoining mines. Now, however, a ₱100,000 electric plant is being installed, and it is believed that with the modern machinery that is to be introduced, the work may be completed in four years. Pachuca is now spending close to ₱1,000,000 per year in handling its water, but with the completion of the adit the greater part of that amount will be saved, as the adit will strike in about 200 metres deeper than the present lowest workings, will be 10 kilometres in length, and will drain El Chico, Pachuca, Real del Monte, and Azoyatla.

The camp of El Oro, in the State of Mexico, has not been materially affected by the decrease in the price of silver, for the greater value of the ores being in gold the higher rate of exchange has tended to equalize the loss in the silver value by reason of the low price of that metal. The three principal mines, El Oro, Esperanza, and Dos Estrellas, continue with about their same productions and high returns of something over $100,000 per month each. On the other side of the hill from the Dos Estrellas, in Tlalpujahua, the La Lucha mine has made a nice strike, and its 50-ton mill, which is in course of construction, will probably be placed in commission during April. Neither the Sirio nor Los Pleyades shafts of the El Oro Mining & Railway Co. has found the San Rafael vein, so that some uncertainty is felt in that quarter, but it is believed that it is a faulting and that the vein will be found by the shaft of the Descubridora company. For the last 250 ft. in this shaft good stringers assaying well have been encountered, and at the 750-ft. level two cross-cuts are being run, and the same are closely watched, as they should test the value and extent of the Chihuahua, Calera, and Descubridora veins, and the southerly course of the San Rafael vein, which latter, if proved, will open up a large new territory of great value to the El Oro district.

The Patio Process.

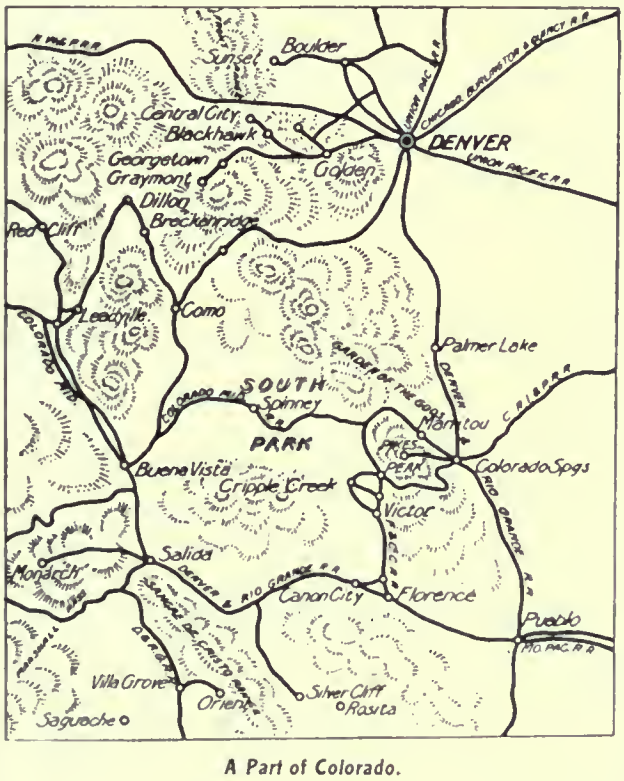
BUTTE, MONTANA.

Resumption of Mining.—Cost of Copper.—Surplus of Labor.—Butte Consolidated.—Butte & London.—Ore Market.

The return to normal mining at the Amalgamated properties is slower than had been expected, though Mr. Gillie said when orders for resumption were given that the normal output of ore from the mines would not be reached before the first of April. It is yet too early to determine if the orders for better results from the miners and the observance of greater economies in operations have borne fruit, but it is believed that when the returns are made from the various departments that they will show a material reduction in the cost of Amalgamated copper. It had been generally believed that the average cost of Amalgamated production was, during recent years, in excess of 11 c. per lb., but it is stated on good authority that the cost was not more than 10½ c. per lb., including refining and selling. It is the expectation that this will be reduced. The cost of production during recent years increased rapidly, in spite of the fact that the value of the ore mined increased also. The increasing cost was due, however, to causes that affected other districts as much as

they did Butte, such as the higher price of lumber and other supplies, the increase in wages, shorter hours, and inefficiency of labor.——The resumption of mining is raising a serious difficulty, as thousands of idle men from all parts of the West, including hundreds of Nevada miners who were locked out by the trouble at Goldfield, have been flocking to Butte, and there are thousands of applicants for work for whom there are no places.

The new section of the Butte district several miles north of the North Butte mines, which the Butte & Bacorn Co. started to develop, is being demonstrated to be of great promise by the Butte Consolidated Copper Co. This company, of which Capt. Alvin P. Nipgen of Butte is president, is financed by Cleveland and other Eastern capitalists. It owns 10 patented claims adjoining the properties of the Butte & Bacorn on the north, and also has 24 unpatented claims. When the Butte & Bacorn Co. stopped work, the Butte Consolidated began to develop its ground



A Part of Colorado.

by sinking a two-compartment shaft on the Susie claim. The shaft has reached a depth of 150 ft. and opened such a large volume of water that the miners were flooded out. The shaft is sunk on the vein and sulphide ore was reached at the water-level. The sulphide and the water are significant and encouraging indications. Assays of gold and silver, and a trace in copper have been taken. No water in any quantity has been encountered by any of the other developing operations in the neighborhood, and even the Butte & Bacorn Co., at a depth of 1000 ft., has very little water. The surface and vein characteristics are identical with those of the famous Anaconda hill. The Butte Consolidated Co. has a fine tunnel-site and may conclude to open the property by that means, but that has not been decided on. An adit would give a depth on the Susie vein of about 500 ft.——There are no immediate prospects of a resumption of work by the Butte & Bacorn Co., as financial conditions among its Pittsburg friends have not yet become satisfactory. The company has a lot of money coming on subscriptions, but since the panic it has been impossible to collect it.

The Butte & London Co. is continuing its exploration work on the 1100-ft. level, and the results are becoming most satisfactory. The east drift from the south cross-cut is showing up well. Assays yield an average of 5.7 oz. silver, $2 in gold, and 2.3% copper. The character of the vein encourages the belief that a large body of commercial ore will be opened soon in that vein.——The Davis-Daly Estates Copper Co. has cut another vein in the Colorado. It was found by the east drift from the 1000-ft. level, but its extent is yet unknown, as driving is being done on a 2-ft. vein of ore, which is being opened. The ore assays 40% zinc, and contains little else in mineral value, but it is worth $15 per ton to the company. This vein, like the one opened south of the shaft, has a northwest strike. Work is also progressing in the cross-cut on the 800, which will develop the vein that was opened on the 1000-ft. level south of the shaft.

With the re-opening of the Washoe smelter at Anaconda and the announcement that it will again receive custom ore, a number of lessees are starting work in this district. As the North Butte is transferring all its ore to the Washoe plant, the Butte Reduction Works is open to a larger number of custom ore shippers. The East Helena smelter has also reduced its rates somewhat, and a number of markets are therefore being offered to lessees.

DENVER, COLORADO.

Activity at Leadville.—The Vidler Tunnel.—News From Idaho Springs.—Upper Clear Creek.—Mining at Silverton.—United Rico Mines Co.—Output of Cripple Creek.

Leadville is slowly coming back to normal conditions as the general metal market improves. Output for February was approximately 60,000 tons, which is a 10% increase over the preceding month. The re-opening of the Tuscan mine contributed largely to improve conditions, and this mine will add considerably to its working force during March. Many of the smaller properties in the district have resumed work, and are maintaining a small daily output. William P. Malburn of Denver has purchased a sixteenth interest in the Greenback property at Adelaide Park, near Leadville. The control of this mine is now in the hands of W. A. Clark and others of Salt Lake City.

Georgetown is getting a great deal of undeserved notoriety, especially in England, by the exposure of the Vidler tunnel scandal. It is another case of a promoter getting into the confidence of foreign and American capitalists and convincing them that it was unnecessary to have a reliable engineer's report on the property before they invested. It is to be hoped that this simple rule will be learned some day by all who have money to invest in mining ventures. ——Operators at Idaho Springs have been wanting a local smelter for some time. The recent development work on the Saratoga lateral from the Newhouse tunnel has been so encouraging that the manager of that property has leased the smelting plant at Golden, which belongs to Berry brothers of Detroit. Repair work is now in progress. It is estimated that the mine will be able to supply the smelter, should the present rates be cut by competition to such an extent that custom smelting would become impracticable.——The Headlight and Halifax claims near Empire have been let, with option to purchase if the examination is satisfactory. The workings are being unwatered preparatory to inspection. The properties are equipped with hoisting and pumping machinery and all necessary buildings.

There is more than the usual amount of development work in the Upper Clear Creek district. All the mines connecting with the Newhouse tunnel are working larger forces than for several months. Lessees in the Gem mine are finding especially good ore. The only difficulty now apparent in the dis-

trict is the inability on the part of many to get their ore to market as fast as produced. The Summit vein in Silver Age gulch has been cut again at over 500 ft. on the dip. This was a good producer in the upper levels and has been eagerly sought several times since it was lost, pinching out, apparently.

Mining activity in Silverton is seriously affected by the recent snow-slides. The soft weather of early March caused several slides to run, doing considerable damage, and injuring a few people. The Iowa mine had part of its buildings demolished and some of its employees injured. One slide carried away part of the Silver Lake tram, and badly wrecked the tram-house. Mine buildings have been destroyed by the slides on Mineral creek. Telephone lines throughout the district are down, as are also the power lines of the Animas Power Co. The damage thus far reported will amount to at least $16,000. ——The property of the Custer Mining & Realty Co. has been sold by the sheriff to satisfy a claim of only $745.——The Bull Domingo mine, which was closed recently on account of a cave, is being reopened.—— The United Rico Mines Co., at Rico, has changed the Pro Patria mill to treat lead-zinc ore by magnetic concentration. The company has also given leases on some of its property on Newman hill. Increased activity is evident at Telluride and Ouray. The ore-carrying companies are increasing the number of their teams and burros as much as 50% in some cases.

The control of the El Paso company is settled for another year, and now the reports from Cripple Creek should become less belligerent than of late. The old board of directors was re-elected. The Drainage Adit is progressing rapidly, having advanced 350 ft. in the last thirty days. This excellent progress is encouraging to operators whose ore reserves above the water-level are limited. A drilling contest, which is to last 14 days, has been arranged by the different makers of the small hammer-drills used in the camp. The contest is to be held in the Last Dollar mine, which is under lease to the Western Investment Co. The arrangement is for 4-ft. holes in sinking, raising, and driving. The competing machines are the Shaw, Waugh, Murphy, McFarland, Sullivan, Traylor, Hardsocg, and Jones. The first conviction under the new law which makes 'high-grading' equivalent to grand larceny, was made in the District Court at Cripple Creek on March 7.——The output from Cripple Creek for February was 58,222 tons, exceeding the tonnage for January by 1,437 tons. The value of the output was $1,241,613, which is $94,207 less than the preceding month. The decrease in the grade of ore was due to the recent favorable rates on low-grade ore. It is now possible to ship at a profit ore worth less than $8 per ton.

The demand for leases was never so great as at present. There is scarcely a mining company that has any promising ground that has not received several applications. Dump leases are especially sought. The manager of the Stratton estate reports over 100 applications for such leases. A large number of properties that have been idle for several years are starting up, and in several instances good strikes have already been made. The ore-hauling concerns are unable to transport all the ore offered to them. They are increasing their equipment as fast as possible. The railroads are likewise being pushed to their fullest capacity to get the ore to the plants at Florence and Colorado City. The deep drainage adit continues to advance at the rate of a little over 10 ft. per day, which is just twice the rate under the former contractors. The contract for the intermediate shaft has been let, and work is already in progress at that point.——The Portland Gold Mining Co. is being sued by the State of Iowa for taxes claimed to be due. The Portland company was incorporated under the laws of Iowa, and that State now regards it as an outside corporation and subject to the tax which the State law levies on such corporations. The outcome of the case is of considerable interest, as well as the feeling which it indicates as growing in the minds of legislators that if a corporation receives something from a State, the State should likewise receive something from the corporation.

TORONTO, CANADA.

The Canadian Mining Institute.—Important Meeting.—Valuable Papers.—Exciting Election.

The annual meeting of the Canadian Mining Institute was held at Ottawa, commencing March 4, and was largely attended. F. Keffer, the president, in his annual address referred to the expected visit of the London Institution of Mining & Metallurgy next autumn, on the invitation of the Canadian Institute. He expressed gratification at the growth of the Institute, the membership of which had increased from 500 to upward of 700 during the year. He deprecated the dissension that seemed to be developing between the Ontario and Quebec members, and favored the preservation of the national character and scope of the organization, in preference to the formation of provincial bodies.

A very full program of papers and addresses was presented. R. Hedley described how 3000 tons of ore per day was handled at the Granby mines and smelter. H. P. H. Brumell read a comprehensive paper on the 'Modes of Occurrence of Canadian Graphite.' J. Obalski spoke concerning 'Gold in the Eastern Townships of Quebec,' where a quarter of a century ago mines had been worked along the Gilbert river, in the Chaudiere valley, yielding gold to the value of $2,000,000. D. B. Dowling, of the Canadian Geological Survey, described mining conditions in the Rocky Mountains, showing a number of fine photographs taken by him in the course of his explorations for coal. John McLeish, of the Canadian Department of Mines, presented the preliminary report on the mineral production of Canada in 1907. The total production was $86,183,477, as compared with $79,057,308 in 1906. Of last year's production, $42,434,087 was metallic and $43,449,390 non-metallic. The items of metallic production were as follows: Antimony ore, 2016 tons, $65,000; copper, 57,381,746 lb., $11,478,644; gold, Yukon, $3,150,000; elsewhere, $5,114,765; total, $8,264,765; iron ore (exports), 25,901 tons, $45,907; pig iron from Canadian ore, 107,599 tons, $1,982,307; lead, 47,565,000 lb., $2,532,836; nickel, 21,189,793 lb., $9,535,407; silver, 12,750,044 oz., $8,329,221; cobalt, zinc, etc., $200,000. Of the non-metallic items the most important were asbestos, 62,018 tons, $2,482,984; coal, 10,510,961 tons, $24,560,238; petroleum, 788,872 bbl., $1,057,088; and portland cement, 2,368,593 bbl., $3,374,828.

A number of papers dealt with iron ore and iron and steel manufacture. One of the most important was by C. K. Leith, who, in a paper on 'The Iron Ores of Ontario,' pointed out the opportunities presented by Canada for metallurgical industry. A. B. Willmott, of Sault Ste. Marie, in treating of the iron and steel industries of Ontario, presented some interesting facts as to the development of these enterprises. R. H. Sweetzer, of Columbus, Ohio, dealing with the use of charcoal as blast-furnace fuel in northern Ontario, contended that the abundance of material for this fuel should make the province independent of all outside fuel sources. F. N. Flynn, Arthur A. Cole, and Frank C. Lowry read papers dealing with the Cobalt silver deposits.

Resolutions were adopted favoring the continuation and increase of the bounty on lead, and a deputation was appointed to wait on the Government regarding the matter. Dr. Goodwin moved a resolu-

tion recommending to the Minister of Mines that a conference be held with the heads of the provincial bureaus of mines to devise, if possible, a uniform method of collecting statistics and valuing mineral products. The resolution was adopted. The election of officers resulted in a keen contest over the positions of secretary and treasurer, many of the Ontario delegates favoring the election of H. E. Haultain for secretary, and Milton L. Hersey as treasurer, with a view to having the headquarters of the Institute removed from Montreal to Toronto. The number of votes cast was 342, the largest in any election so far held, and the result was in favor of the old officials. The following were elected: President, Willet G. Miller, by acclamation; 1st vice president, G. E. Drummond; 2nd vice president, W. F. Robertson; secretary, H. Mortimer Lamb; treasurer, J. Stevenson Brown; council, W. M. Brewer, Arthur Cole, R. H. Drury, Chas. Fergie, J. E. Hardman, R. T. Hopper, J. McNabb, W. F. C. Parsons, R. W. Robb, O. B. Smith, R. H. Stewart, and J. B. Tyrell. The question of a change in the headquarters will be decided by a mail vote.

A good deal of attention is being attracted to the new camp lying south of the township of Lorraine in unsurveyed territory, where a discovery was first made in the fall, since when over 200 claims have been taken up. It lies three miles west of Lake Temiskaming, and about 22 miles south of Cobalt. The Haileybury Silver Mining Co. started to work on a location here some weeks ago on a vein of cobalt-niccolite, carrying silver, and is sacking ore from an open-cut. The Keeley property is also yielding ore. An early rush to the camp is expected. It is about 10 miles distant from Temagami station on the Temiskaming & New Ontario railway. Shipments in the summer can be made by way of Lake Temiskaming.

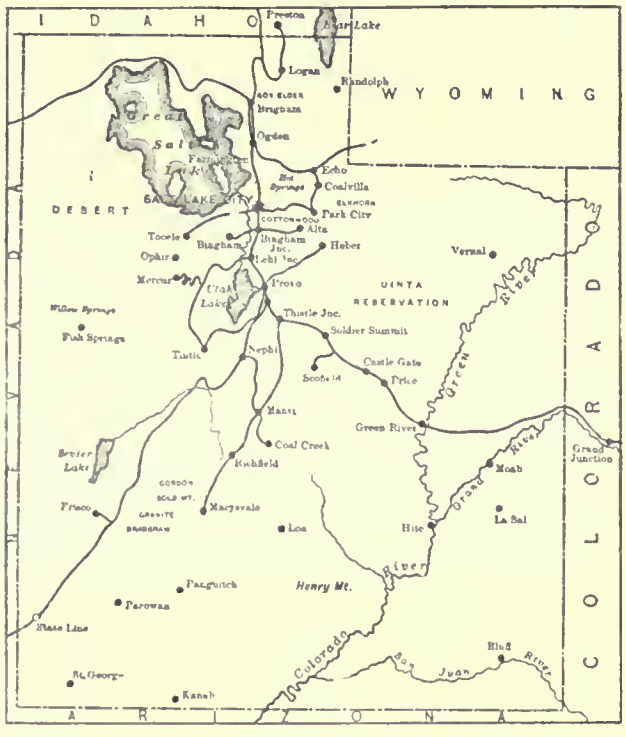
SALT LAKE, UTAH.

Sale and Consolidation of Mines.—Shipments From Park City.—Output of Tintic.

The revival of mining at Butte and other parts of the West is being felt in the coal camps of southern Utah. The demand for fuel has increased. Sunnyside coke is in demand at the Butte and Anaconda smelters.——A deal has been closed for the sale of the Century mine in the Park Valley district (in Boxelder county) to a New York syndicate. The first payment has been made, and the second will be forthcoming in 90 days. The Century mine has been a dividend-payer in the past, and is equipped with a good milling plant. The purchasers propose to install an electric-power plant and operate the property upon an elaborate scale.——The merger of the Ohio Copper and Bingham Consolidated properties is being arranged satisfactorily. The Bingham Con. properties, which are in debt nearly $1,500,000, are to be turned into the Ohio Copper Co. free of incumbrance, and it is understood that in consideration of 3⅓ shares of Ohio stock being issued for one share of Bingham Con. stock, the shareholders of the latter are to turn into the Ohio treasury $1,000,000 in cash. The proposition will shortly be submitted to the shareholders of both corporations.——The Utah Copper Co. has had trouble lately with the power-plant at its Garfield mill, and therefore the production during March will fall short. For the same reason, the ninth section of the mill has not been placed in commission, but it is ready to start.

Ore shipments from the Park City mines last week amounted to 835 tons, the contributing mines being: Daly Judge, 254; Daly West, 149, and Silver King, 432 tons. The water in the Ontario drainage adit is receding at the rate of more than four feet per day, and at last accounts was 80 ft. below the 1200-ft. level of No. 3 Ontario shaft. It is expected that the drainage will be complete to the adit-level before the end of May, when it will be possible to clear out the last section of the obstructed portion of the adit. It is generally considered that the Ontario drainage adit is the key to profitable mining at Park City, and its restoration is eagerly awaited. In the American Flag and other mines, levels that have been flooded since the caves occurred, over three years ago, are now accessible.——The new zinc plant of the Grassalli Chemical Co., at Park City, will be in commission about April 1. It will begin operation on zinc middling from the Daly Judge mill.

The case of the Black Rock Mining Co. against the State of Utah has been won by the defendant. The suit was brought to test the constitutionality of the incorporation tax law passed at the last session of the legislature. An appeal will be taken to the Supreme Court of the State. The plaintiff set forth in the complaint that the enforcement of the law would amount to double taxation and therefore could



Utah.

not be constitutional.——The Black Jack Mining Co., at Tintic, has begun driving a 2000-ft. tunnel, which, when completed, will reduce the cost of ore extraction as well as expense of transportation to the smelter. The Eureka Hill railway will transport the ore to the Tintic Smelting Co.'s plant for 25 cents per ton.——A special meeting of directors of the Columbus Consolidated Co. is scheduled to be held during the week, and it is probable that an assessment of 20 cents a share will be levied. The Columbus is at Alta and last year paid out $226,000 in dividends; but production ceased when metal prices fell last autumn. In the meantime, development work has progressed, with the result that the company has overdrafts at the bank.——The directors of the Nevada Hills Co. have decided to pass the March dividend, and it may be several months before another one will be posted, since mill construction and other improvements are planned. The Nevada Hill mine is at Fairview, Nevada, but the headquarters of the company are here.——Ore shipments from Tintic last week amounted to 53 car-loads, the contributing mines and amounts being: Centennial Eureka, 45; Bullion Beck, 5; Eureka Hill, 2; Tintic Iron, 1 car-load. All but about 50 tons per day of the Centennial Eureka product goes to the Mammoth smelter at Kennett, California, for treatment.

RAWHIDE, NEVADA.

The Boom.—Character of the Ore.—Specimens and Assays.—Mill Construction.—Distribution of Claims.—Leasing Companies.—Reported High-Grade Ore.

The town of Rawhide is built along an arroyo that drains southerly to a desert flat surrounded by mountains. On the east side of the arroyo are Grutt, Balloon, and Murray hills, connected, one to the other, by saddles; while on the opposite side is Rosebury or Hooligan hill. These hills are centres of activity in prospecting and development. Another centre of activity is in the foothills of the higher range two miles west of town, where there are two or more parallel veins having the same north-south strike as those that cut through Grutt and Balloon hills. The holdings of the Rawhide Queen Mines Co. cover the major part of Balloon hill, containing what is believed to be three different veins. On the westerly slope of the hill is the principal vein, having a rhyolite dike as the hanging wall, giving the vein an easterly dip. Another vein, having the same general strike, is found on the easterly slope, but having a westerly dip. At the top of the hill is a fairly defined vertical vein. Kearns leases No. 1 and 2 cover a portion of the vein on the westerly slope. The principals in this company are E. W. King, W. Law, Daniel Snowgosse, J. H. Barrett, and G. W. Lloyd. The company has leased out most of this ground to 15 sets of lessees, the term of leases being 18 months. The Kearns leases have two shafts over 100 ft. deep, with some cross-cuts and drifts, showing 8 ft. of ore on lease No. 2. The ore sacked and shipped is said to have run from $117 to $200 per ton. A gasoline hoist has been installed on this property. The Rawhide Lode Leasing Co., having a lease on a portion of Balloon hill's principal lode, has a 130-ft. shaft, with a cross-cut at the 100-ft. level to the ore, showing a vein 10 ft. wide said to assay $100 per ton. L. R. Thatcher, manager of this lease, has ordered a gasoline hoist.——Grutt brothers practically control Grutt hill, which has one well defined vein cutting through it. Much of this ground is leased. The Grutt Mining Co., operating a lease on the Wild West claim, has 6 ft. of ore said to be worth $200 per ton. The same company is developing the Grutt fraction. The Last Chance lessees, on the north end of the hill, have five shafts from 10 to 50 ft., with some open-cuts, showing ore. Grutt Bros. likewise have 190 acres on Murray hill, the Grey Eagle Fraction between Balloon and Grutt hills, and some ground between Murray and Rosebury hills. The Murray lease on Murray hill is one in which some excellent ore has been uncovered.——The Owl group, on the south slope of Rosebury hill, contains 95 acres, and is in the hands of 27 lessees, 20 of whom are at work. On this hill there appears to be a number of veins, which carry silver in sulphide and chloride form, as well as gold. The greatest depth here is 50 to 60 ft. The Big Four Leasing Co., operating on Murray hill, has some of the highest-grade ore thus far found in the district. The vein is 4 ft. wide.

The Miller lease, on Rosebury hill, was taken over by Thos. Kearns and associates. It has an 80-ft. shaft and 100 ft. of drift on the vein at the 50-ft. level. It is asserted that it contains three feet of ore that samples $300 per ton.——The Rawhide Coalition Mines Co., owning the unsold lots in the townsite and adjacent mineral ground, is now in control of E. W. King and asociates. The Rawhide Junction M. Co., having ground on the lower part of the gulch, has let 12 leases, and some of the lessees are at work. By sinking to bedrock, at 54 ft., the wash was found to be of value as placer ground. It is stated that both wet and dry placer machines are to be used to handle the stuff. Charles A. Gehrmann of the Bank of Rawhide is concerned in this enterprise.——In the western part of the district are the Royal, Tiger, Bushwhacker, Jack Pot, Nevada King, Regent, and others. Here the veins are well defined and strong, and at 50 to 115 ft. depth a good grade of ore has been obtained. The Royal is under lease to John E. Pelton and associates, and a considerable tonnage of ore is being sacked. There are more sulphides in this ore than appears in that of Balloon and Grutt hills. The Tiger is so located as to enable the lessees to develop through adit levels. One of these opened an 8-ft. vein of ore, some of which runs $200 per ton. The lessees are R. E. Lee and C. G. Elliott. The Bushwhacker was sold to Capt. G. W. Thatcher for $20,000. It adjoins the Royal and Tiger, and has two veins carrying high-grade ore.

There are approximately 300 leases in force in the district, and many of the lessees are companies, whose stocks are on the market. Many of the leases are offered for sale at high prices; the fairly long terms of the leases, one to three years, make them attractive to traders and speculators. While much work is in progress on some of the leases, there are others apparently being held for sale, and the work being done is merely to meet the agreements.——C. E. Loss of the California Contracting Co., E. W. King, Fred Grutt, and S. D. Crump are the organizers of a company that purposes building a railroad from Schurz to Rawhide, a distance of 31 miles. It is announced that the road will be built within the next six months. J. A. Carmichael has spent some time in Rawhide making tests with a view to erecting a custom mill. He believes Rawhide will eventually become a great milling district.

When the psychological moment arrived, Rawhide blossomed forth in all her glory as a full-fledged town with over 6000 fortune-hunters. The strike at Goldfield, the closing of mines in other localities, and the fact that there had to be a mining excitement in Nevada, made Rawhide possible. Aside from this, it is a fact that Rawhide has some extraordinarily rich surface showings, some of which are merely knife-blade streaks; but the gold is there and the lessees and mine-operators have faith that these 'knife-blades' will open out into bonanzas or enrich the dikes sufficiently to make shipping ore. Some of these expectations have been partly realized. The dikes of quartz porphyry and andesite breccia, when sufficiently silicified, yield profitable ore, but the dikes are only mineralized in part; if they were mineralized throughout one could figure on a certain tonnage of a given class of ore, but such is not the case, so that good ore in one portion of a dike is no guarantee of the same condition in other portions. As to the mineralization continuing downward, there is a marked improvement to the shallow depth already reached, but whether this will extend below the zone of secondary enrichment remains to be proved.

There is no doubt that with favorable conditions, such as cheap and efficient labor, cheap power and timbers, there would be ore for many large mills; but such is not the case; with high union labor, almost prohibitive timber costs, and no cheap power, only the best grades of milling ore can be worked. Some of the lessees are shipping ore ($50 to $250), but the great majority are only expending money.

The camp is an ideal one for boom purposes; high assays are common, the ore yields fine specimens, and the area over which good ore has been found bids fair to make a number of profitable mines. As compared with Goldfield at the same age, the comparison is in favor of Rawhide; but the deposits being of a character not well understood, the future is difficult to predict. The sociological experience of Goldfield is likely to be repeated here, and a new boom in some

other locality in Nevada is apt to divert interest to a fresh scene of excitement.

A branch railroad from Schurz to Rawhide will be built, and as there are no engineering difficulties to be overcome, the construction will depend upon the delivery of construction material at Schurz. There is talk of half a dozen mills being put up here, but this will depend upon how readily the public subscribes to the undertakings. That there will be a big mill here or at Walker lake, there is little doubt, but there being no regular tonnage available or possible to be guaranteed at present, it is too soon to figure on big mills. We are in the assay stage, with the usual exaggerations. The $76,000 assay from the Hooligan claim came from a stringer, it represents a sack-full of ore and it may take three months more work to get another sack-full of the same kind of stuff. When a stringer like this is blasted, an assay of the fine stuff from the bottom of the shaft may yield $400 for "the full width of the shaft." That sort of thing is common in all boom camps. It misleads the inexperienced.

The I. X. L. Mining & Leasing Co. has a 15-hp. gasoline hoist ready to put up. The shaft is down 75 ft., and driving and cross-cutting will be started on the 100-ft. level. On the Big Four lease within 6 ft. of the surface some very rich ore was uncovered. The stringer is from ½ to 6 in. wide and shows big crystals of gold. Kearn's No. 2 lease does not exhibit such a specimen ore, but it pans better over a wider area. The Burns lease on Silver King hill shows a 16-in. streak of blue quartz mineralized with sulphides.

LONDON.

Cornish Tin Mining.—Broken Hill Proprietary.

The results at Dolcoath during the second half of 1907 show what effect the fall in the price of tin has had in reducing profits. The total amount received from the sales of concentrates was £80,549, as compared with £104,094 during the first half of the year. The ore crushed was 49,795 long tons, yielding 845 tons of concentrates. The product per ton of ore was 38 lb., and the average price of the concentrates was £95 6s. per ton. During the first half of the year 51,243 tons of ore yielded 863 tons of concentrates, the product was 37½ lb., and the price £120 11s. 9d. For the last five years the output and yield per ton have kept at about these figures, and the price of tin has been the sole cause of variation in the receipts. Twelve years ago, when the present company was started, the amount of ore crushed was about three-fifths of what it is now, and the product of concentrates per ton was almost exactly double, so that the actual output of concentrates was over a thousand tons in the half-year. On the other hand, the price of tin was wretchedly low, the average return from the concentrates being only £30. To return to the past half-year, the total income from all sources was £82,415, the working costs were £60,283, and the lord's royalties £5376, leaving a net profit of £16,755. This compares with a profit of £41,421 during the first half-year. The directors propose to pay a dividend of £12,750, which is at the rate of 7½% on the paid up capital of £340,000. During the previous half-year the dividend was at the rate of 20%. The company is well provided with working capital and has ample reserve cash. These resources consist of £47,798 in cash and £28,390 in consols, and were accumulated during the recent boom in tin. Perhaps the most interesting item in the report is the income of £130 from the sale of copper and arsenic. Though small, it shows that the Elmore vacuum plant mentioned by me in a recent issue is beginning to yield returns. The amount mentioned is not very much, it is true, but I look for substantial returns during the current year.

The fall in the price of tin has hit the Carn Brea & Tincroft company in such a manner as to bring the balance on the wrong side for the half-year ended in December. The receipts were £41,363 and the working costs £42,726. In addition, there were lord's royalties amounting to £1568, so that the loss on the half-year was £2931. The ore is lower grade than at Dolcoath, and it contains wolfram, arsenic, and copper as well. The ore treated was 29,677 tons, and the tin concentrates sold was 396 tons, a recovery of 29.9 lb. per ton. The receipts from tin concentrates were £34,649, an average yield of £87 per ton. I would here interpolate the remark that I use the plural advisedly when speaking of concentrates, as every Cornish mine produces a series of grades. The receipts at Carn Brea & Tincroft included £140 for copper ore, £2323 for arsenic, £689 for wolfram, and £3871 for tin in residues. These two mines have belonged to the present company since 1900, and production has been pretty regular. As a rule the balance has been on the wrong side and, owing to the method of bookkeeping, it is somewhat difficult to ascertain whether the costs are charged to capital or revenue. During 1905 and 1906 and the first half of 1907 the accounts showed profits. My own opinion is that the company should raise new capital and re-organize its methods of working and dressing. The accompanying photograph is a view of Dolcoath and Carn Brea that I took when in Cornwall last October.

A Group of Cornish Mines.

The Broken Hill Proprietary Co. has published the results of working during the six months ended November 30. The ore treated was 298,327 tons and the output was 2,785,535 oz. silver and 29,612 tons of pig lead. The average prices obtained were 2s. 9d. per oz. silver and £16 4s. 9d. per ton lead. The zinc concentration plant treated 175,021 tons of zinc tailing, producing 41,203 tons of zinc concentrate. The profit for the half-year was £137,642, being 8s. 9d. per ton of ore treated, as compared with £1 0s. 9d. during the previous half-year. This drop is accounted for chiefly by the fall in the price of metals, but it is also due to the extra expenditure on development, £40,000 having been spent in this way, equal to 2s. 6d. per ton of ore treated. The company had in hand large balances of undistributed profit from the two previous half-years, so it has been able to pay £288,000 in dividends during the half-year in question.

Concentrates.

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

The speed of a belt is found by multiplying the diameter of the pulley in feet by 3.14 and by its revolutions per minute.

One pound of natural gas occupies 22 cu. ft. at 62°F. One cubic foot requires 10 cu. ft. of air for its combustion, and evolves about 1000 B. T. U.

The Sutro tunnel enters the Comstock lode at a depth of 1700 ft. The length of the main tunnel is 3⅞ miles, and the cost of construction, $2,096,566.

Antimony in gold ore forms a voluminous amalgam, and gives considerable trouble in the clean-up, though it does not in any way hinder amalgamation of the gold.

Selenium occurs in the ores of Tonopah, and the presence of it is indicated by the cherry color of the condensed fume obtained when parting the bullion in the last slag of smelting.

Secondary enrichment at Butte is exceptional in regard to the depth at which secondary sulphides occur. The ground-water level has risen as a result of faulting on the western face of the granite hills to the east of Butte.

A one-inch four-ply belt, traveling 900 ft. per min. will transmit 1 hp. The power increases in direct proportion with the speed and width of the belt. For instance, a 2-in. 4-ply belt traveling 1800 ft. per min. will transmit 4 horse-power.

In the chlorination of gold ores, the water should be filtered free from organic matter and should contain neither alkaline salts nor ferrous sulphate in solution. Thus mine-waters, sea-water, and water from many springs and lakes is unfit for use without purification.

In the construction of dams and embankments, the effect of shrinkage should be carefully considered. This may amount to 15% or more. If a rubble dam is to be faced with concrete, care should be taken to allow the fill to settle as completely as possible, so that shrinkage cannot cause cracks in the facing.

Fire-killed timber checks badly when left in the tree, and this is an obstacle in the way of utilizing it for some purposes. For the manufacture of lumber it should be used, if possible, within a year after it is killed, but satisfactory railroad ties have been made from timber killed fifty years previously.

The sulphuric anhydride discharged from the Washoe smelter at Anaconda would produce 2500 tons of sulphuric acid per day. If it is condensed, it will be difficult to find a use for this quantity, but a reduction in cost will develop new processes, and it will stimulate research in the wet methods of ore reduction.

Sulphuric acid is a by-product from the smelting of pyritic ores, and is manufactured locally by the Mountain Copper Co., the Peyton Chemical Works, and the Standard Oil Co. The last mentioned uses the acid in refining its own oil, while the Mountain Copper Co. manufactures super-phosphate, which is used as a fertilizer.

Wet milling is now so general that dry milling is regarded as unusual practice. As a matter of fact, dry milling is by far the older method, and it only gave way to wet milling gradually when it was found that water assisted in clearing the mortar of pulp and assisted in the separation of the valuable minerals from the waste.

Cross-cutting is not sufficiently practised in most mining districts. Parallelism in veins and ore-shoots is common, and systematic cross-cutting usually develops ore. When a cross-cut is stopped, a drill-hole should be driven into the face for 5 or 6 ft. and the drillings assayed. Such a hole is almost as effective as driving the drift forward 5 ft., and is much cheaper.

Legal money is a term technically applied to the gold and silver coined by the Government, the certificates of deposit issued against the same, and the United States notes, all of these being by the statute legal tender. The expansion and contraction of these forms of currency have been regulated partly by statute and partly by the automatic influence of gold production.

Economy in timber has been effected in many collieries by making the ends of the timbers somewhat pointed, so that when the pressure of the ground presses on the end of the timbers, the weakest part is the end, and the timber will fray at the end instead of breaking in the middle. When the timbers are removed, they can be used again, and the loss of length does not exceed a few inches.

Amalgam often contains base metals, such as iron and antimony. After retorting, the resulting sponge may assay as high as 50% of iron. Iron readily amalgamates in presence of sodium amalgam, and in cleaning up batteries where sodium amalgam is used the iron is frequently noticed to be slightly amalgamated in spots. The remedy after retorting to recover as much mercury as possible, is to subject the residue to a thorough oxidizing roast, and then wash out the ferric oxide by means of sulphuric acid, before proceeding to melt the bullion.

Lead is said to act like steel at ordinary temperatures when reduced to a very low temperature in liquid air. It will serve as a helical spring, for example. These facts, which keep cropping up, of the behavior of soft, non-elastic metals are interesting. They show how important temperature is. Just as iron is soft and inelastic at a high red color, so lead is dull and soft at ordinary temperatures, for it is well on its way to be melted. Mercury is actually fluid at ordinary temperatures, but can be frozen at about 20°F into a soft metal. At lower temperatures it may, perhaps, be possible to make springs of mercury.

Puddle is a mixture of gravel and clay which is wet and rammed into place. A good mixture is 1 cu. yd. of gravel, 0.35 of sand, and 0.25 of clay. This will make 1.16 cu. yd. of puddle, and will shrink to 1.1 cu. yd. when rammed. If the bottom of a reservoir is to be covered, the gravel is spread in a layer about 3 in. thick, the clay spread over the gravel, and the sand over the clay, in their respective proportions. An ordinary harrow is then dragged over it until mixing is complete. Water is next sprinkled over it in amount sufficient to cause the mass to knead like stiff dough under a two-ton sectional roller. Such a puddle is as heavy as concrete, and resists abrasion almost as well. The cost of puddle is about 50 c. per cubic yard.

Discussion.

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy.

A Theory of Ore-Deposition.

The Editor:

Sir—In Hutton's 'Theory of the Earth,' Vol. I, page 394, may be found the following statement: "That mineral veins have been filled with matter in a fluid state, is acknowledged by everybody who has either looked at a mineral vein in the earth, or in a cabinet specimen; mineralists and geologists, in general, suppose this to have been done by means of solutions and concretions, a supposition by no means warranted by appearances, which, on the contrary, in general demonstrate that the materials of those veins had been introduced in the fluid state of fusion." On page 405 of the same volume it is stated by the same Scotch scientist that "there is not a mineral vein (so far at least as I have seen) in which the appearances may be explained by anything else besides the operation of fire or fusion."

These views, which were published in 1795, may well be looked upon as extreme; and the author can hardly escape the criticism of having generalized upon too few facts.

In 1900 Mr. J. E. Spurr published one of his illuminating and suggestive treatises upon 'Ore Deposits,' discussing in this instance* those of Monte Cristo, Washington, of which he speaks as follows: "The ores in the Monte Cristo district consist of pyrite, pyrrhotite, arsenopyrite, blende, galena, and chalcopyrite. Realgar as an alteration product from arsenopyrite is common. Among the rarer minerals are chalcocite, bornite, molybdenite, and stibnite." The ores carry relatively small amounts of silver and gold.

"In the observed veins of the district it is found that the ores are most abundant near the surface."

"Upon various grounds it has been concluded that the upper sulphide zone, which contains the most and richest ore, was deposited, largely at least, since the development of approximately the present topography, by downward tending waters. Lead, one of the most conspicuous metals of this zone, is not known to be present in the lowest ores, and so is not regarded as having been derived by the concentration of ores like those in the lowest zones; but is, perhaps, as the known facts indicate, an original deposit by descending waters. This theory involves the derivation of the lead ores from the surrounding rock. The lower sulphide zones afford less evidence as to their origin, but what there is tends in the same direction as that for the upper zones, so that the general suggestion is deduced that all the zones were precipitated, in part simultaneously, by downward percolating waters, the different belts of mineral being precipitated in order according to their relative solubility. Similar phenomena in other regions, and the known chemistry of such phenomena, support these deductions derived from independent local evidence."

* U. S. Geol. Sur. 22nd Ann. Rep. Pt. II, pp. 777-865.

In brief, Mr. Spurr presents in this report the theory that all the ores of this district, even the most complex and base, were derived by solution from the adjacent rocks, and deposited in joints and other fractures (while the present topography was forming) by descending waters. This again is an extreme view. I do not recall another instance in recent years of such radicalism on the side of the discensionists.

Once more the wheel turns; and in the MINING AND SCIENTIFIC PRESS of February 22, 1908, Mr. Spurr most ingeniously presents a line of reasoning that leads him to conclude "that most ore deposits and mineral veins, as a class, represent one or the other of the extreme products of magmatic differentiation"; and this theory is said to cover, "with a few doubtful exceptions, all the important deposits of metals" with which he is familiar.

Here we are, back again to the Huttonian extreme: and possibly falling into his predicament as to generalization. The existence of 'extremes' is in itself an indication of 'means'; and from the known relation between their products it may be possible to determine Mr. Spurr's actual deductions and conclusions. We may at least infer that he is sometimes torn between two desires, and could be happy with either "were t'other dear charmer away."

In other words, it is difficult for one who found much truth in his Monte Cristo report to take him seriously in his latest article, and impossible to believe that he intends to make his theory as broad as his language indicates. Can it be that he includes under the heading of magmatic differentiations the disseminated and replaced limestone ores of the Mississippi Valley, when no eruptives younger than the sediments occur within fifty or a hundred miles? Or the world-wide copper strata of the Permian and Triassic periods? Or the copper ores at Bisbee or Butte, where the valuable ore minerals are so clearly secondary? Or the drainage-slope joint-fillings of Monte Cristo? Of course his theory is not intended to cover the goldfields of the Rand, nor the native copper ores of Lake Superior. Nor does it seem to answer the requirements of the enormous copper impregnations in sandstone in the Congo Free State. The list of possible exceptions that quickly come to mind is therefore somewhat formidable; and we are startled out of our usual attitude of ready acceptance of Spurr's conclusions, to a more careful consideration of his new theory.

What restless fellows, these geologists! We no sooner learn from one authority that ore deposits are formed by underground waters than along comes another who proves that these waters are not chiefly ascending but *circulating*. And when we have settled down to an acceptance of the effective agency of circulating and descending solutions we are shown that they cannot and do not descend very far; but may originally all have arisen from magmas at great depth. Then we admit the agency of magmatic waters in the deposition of primary ores; and presto! we are asked to forget all we know about the deposition of ores from solutions far removed from any magmas; to abandon the firm ground of

the formation of the richer portions of veins by secondary enrichment through descension, and to place ourselves upon the shifting and uncertain territory of magmatic differentiation. We are now to look upon most deposits of the metallic ores, as 'dikes' that are 'intrusive' into the country rocks where they are found. Water itself is to be considered as an ultra-refined magma, and quartz, next to ice, its final crystallization product.

No longer shall we find it necessary to warn clients of the possibility or probability of early exhaustion of their secondary bonanza ores, and the approaching days of famine and leanness; for it will be possible to recognize "successive vertical zones of ore deposition," and "there may result in a vertical section of orebodies (or) zones of deposition separated from one another by barren intervening spaces." In other words, a mine may contain as much rich ore at the depth of two miles as within a thousand feet of the surface. New hope for the prospector; new life for hundreds and thousands of mines abandoned because their ores became too low-grade to mine profitably! No longer need we fearsomely anticipate the exhaustion of our mineral resources; for "the metallic hearth or the factory in which the ores originate is the zone of differentiation, which is in the lower part of the zone of crystallization" (or say from 5000 to 10,000 metres below the surface). And everybody knows that our deepest sulphide mines have not as yet attained the depth of 1000 metres.

It has been customary for several years past for writers on ore deposits to call attention to the generally close relation existing between ore deposits and igneous rocks. It seems about time for someone to emphasize the relation between the richer ore deposits and the top of the ground; for here is a relationship of far greater practical importance and quite as close consanguinity.

Speaking seriously, it seems to me that Spurr has conceived and described magmatic processes and with convincing logic followed them to their legitimate and inevitable results. Exception must be taken, however, to his attempt to make all veins 'intrusive' in the same sense as 'dikes,' and to ignore entirely the effects of descending surface waters in the formation of the secondary ores. For many primary ores in regions of eruptive rocks his explanation is ideal and beyond criticism. It is not apparent, however, how we can escape the conclusion that both ascending and descending waters which long ages ago lost their line of descent from magmas must be constantly at work dissolving, transporting, and re-depositing ores and minerals. And there seems to be something more than suspicious in the constant presence of such waters and of the richer ores within 2000 ft. of the present surface, and the great scarcity of both of them below some such depth.

Another question not quite clear in my mind is as to the method by which most of the volatile watery vapor is to be retained within a cooling and differentiating magma only until differentiation is completed, and why at that particular time "all the accumulated water in the magma" (the aqueous residue), should deposit quartz veins and ores, and then, having "lost most of its heat" and "left behind nearly all of the elements with which it was associated," find its way to the surface and mingle "with the great body of surface and shallow-seated waters which has been so plausibly regarded as the accumulated residue of all crystallized magmas." Why should not some of this water begin to escape upward to the surface as soon as the catastrophe occurred that made differentiation possible in a particular unclassified magma? And what prevented those ascending hot vapors from transporting and depositing ores in the manner usually ascribed to ascending hot waters and vapors?

Is it not a lamentable fact that workable sulphide ores do not extend to great depths? Would they not continue downward practically unchanged, or richer; nay, should they not be encountered at considerable depth and followed to far greater depths if they were truly crystallized magmas?

If it be true that acid magmas possess greater mobility and fluidity than basic magmas, and if because of this fact they solidify nearer the surface, how shall their products be distinguished from the quartz veins and silicious rocks deposited by meteoric waters in circulation in the same zone. Or is Van Hise mistaken in his statement that "of the substances deposited in the belt of cementation quartz is undoubtedly the one which predominates over all others. The one great process in the belt of cementation is silication. * * * Hence it is highly probable that silicic acid is the dominant constituent contained in downward percolating waters. Therefore we have a source both for the deposited quartz and for the process of silication which forms the silicates."†

Another common feature of veins that does not seem to be readily explained by Spurr's theory is that of 'crustification.' This phenomenon is by no means universal, and is more frequently exhibited by genuine fissure veins, that is, those formed in open cracks in the rocks; yet it is also often seen in veins of substitution in shear zones where the rocks are so crushed that it is doubtful whether open spaces could ever have existed. In the latter instances there have been successive periods of rock replacement, and the resultant banding is seldom as minutely and beautifully parallel as in the filling of spaces of discision.

Personally, I am not yet satisfied that some of the richer secondary sulphides, like chalcocite, are ever formed in nature except from sulphate solutions. And since magmatic vapors and hot spring emanations are characteristically alkaline, while descending waters are acid, the very fact of the existence of such ores in a vein indicates the agency of descending waters; and the other phenomena are usually in concordance with that supposition.

In view of Spurr's opening plea for an indulgence until he presents his full discussion and "illustrates" it with facts and specific instances, it is hardly fair to urge further objections at this time. No doubt

† "Genesis of Ore Deposits." A. I. M. E., 1901, p. 332.

he will meet most of them in such manner as to shake to their foundations many of our most thoroughly established theories. And since to no one writer do I feel under greater personal obligations, so much the more readily will I lay aside cherished beliefs and adopt the new ones when complete and satisfactory proof is presented.

HORACE V. WINCHELL.

Minneapolis, March 6.

Biographical Note.

The Editor:

Sir—I notice in your issue of February 29, under the above heading, you mention the death of W. R. Boggs, Jr., who you say "met a tragic death in Mexico, being stoned by a mob of workmen clamoring for their wages." Mr. Boggs was the superintendent for the Topia Mining Co. at Topia, in Durango, Mexico, and in his death the company suffered the loss of a man whose energy, good judgment, and technical ability it will be hard to replace. I was in Topia making an examination of the company's property, and prior to his death, which occurred during my stay, I was with Mr. Boggs much of the time; but he was killed late at night while trying to eject, unaided and unarmed, a number of drunken *peones* from the company's mill. The rumor that the murder was committed by a "mob of workmen clamoring for their wages" was circulated at Durango by a discharged bookkeeper named A. B. Pettersen. The murder took place a day or so before the regular pay-day, and the men were paid off in full at the usual time.

I may add, for the benefit of mining men operating in Mexico, that two of the principals were finally caught, and the company has the assurance of the authorities that they will be promptly executed.

WILLIAM G. DEVEREUX.

New York, March 5.

A Curious Accident.

The Editor:

Sir—A rather extraordinary accident happened in this camp the other day, and as it may be of some interest I shall describe it. Two mining men were examining some rock from the collar of an assessment hole. They had completed their work and were about to leave, when one of the parties picked up a small piece of ore and, carrying it up to where he had been breaking the others, struck it with a hammer; it exploded, blowing out one of his eyes and badly cutting the other. The other party, looking over his shoulder, fortunately escaped with a few cuts. The question naturally arises, why did this rock explode? It was a small piece, had been looked over before breaking, and it seemed the same as the other rock. The only explanation that seems possible is that at some time a stick of powder had been thrown on the dump, and in the hot sun this particular rock had absorbed enough glycerine to make it explosive, as there was no actual powder in the rock.

EARL C. CLEAVELAND.

Mogollon, New Mexico, March 2.

Decisions Relating to Mining.

Specially reported for the MINING AND SCIENTIFIC PRESS.

In California, mining claims are located upon veins or lodes of quartz, or other rock, or veins of metal, or its ores, by posting thereon two notices, written or printed upon paper or some metallic or other substance, each to be posted in such a manner as to expose to view the full contents of the notice, and one of which shall be posted in a conspicuous place at each end of the claim. Such notices shall contain the name or names of the locators, the date of the location, and such a description of the claim or claims, by reference to some natural object or permanent monument, as will identify the claim.

Yosemite Mining Co. *v.* Emerson, 28 Sup. Ct. Rep. (U. S.) 196, Jan., '08.

A person who was employed on an idle oil claim part of the time as watchman, and at other times in pumping oil from the claim for use in the boiler, was entitled to a mechanic's lien for the value of his services in the pumping of the oil, under the statute providing that any person who performs labor in a mining claim, or in or upon real property worked as a mine, either in the development thereof, or in working therein by the subtractive process, has a lien thereon. But for his services performed as watchman, he could only hold the owner liable personally.

Donaldson *v.* Orchard Oil Co., (Cal.) 92 Pac. 1046, Oct., '07.

The 60 days within which the locator must perform his work begins to run from the date of the discovery of mineral and posting his discovery notice; and a locator cannot extend his time to do his work by changing the date on his discovery stake, or by renewing his notice of discovery. There cannot be two discoveries of the same thing by the same person, and the law having fixed the time in which the work must be performed, the locator has no power or authority to extend or enlarge that period for his own convenience. If the discovery shaft is not completed within the legal time, it is mere folly to pull down the old notice and put up another of a later date, as the 60 days begins to run from the date of discovery, and no self-serving act of the locator can enlarge the time. The exact rule may be stated thus: The locator is not permitted to re-enter and oust himself, predicating such re-entry and ouster on his own delinquency, and permitting him to re-enter and re-oust himself periodically to save the necessity of developing his claim. To permit the original locator the power within himself to make effectual a forfeiture arising from his own delinquency by perfecting a relocation, is to place in his hands the extraordinary privilege of holding mineral lands perpetually without doing any location work whatever.

Ingemarson *v.* Coffey, (Colo.) 92 Pac. 908, Dec., '07.

The re-location of an abandoned lode claim must be made by sinking a new discovery shaft and fixing new boundaries in the same manner as if it were a location of a new claim; or, in lieu thereof, the re-locator may sink an original discovery shaft 10 ft. deeper than it was at the time of the abandonment. No less work, and work which is not a substantial compliance with this provision, will amount to a re-location of an abandoned lode claim.

Ingemarson *v.* Coffey, (Colo.) 92 Pac. 908, Dec., '07.

A person will not be permitted to re-locate a claim because of the failure of the former locator to give the notice required by the mining district regulations, where he had knowledge of the location, and the exact boundaries of the former location were pointed out to him; and where the ground embraced within the exterior boundaries of the claim attempted to be located, was the same ground included within the exterior boundaries of the former location.

Yosemite Mining Co. *v.* Emerson, 28 Sup. Ct. Rep. (U. S.) 196, Jan., '08.

FOOTHILL COPPER BELT OF THE SIERRA NEVADA.

Written for the MINING AND SCIENTIFIC PRESS
By JOHN A. REID.

It is a lamentable fact that the literature of mining geology contains so little about the copper belt in the foothill region of the Sierra Nevada. This lack of full and proper description is all the more to be regretted on account of the great value of these deposits. In order that more attention be given to this region by those concerned in legitimate mining, and in view of the fact that some of the essential geological features of the belt have not heretofore been recognized, this brief paper, beginning a complete study and description, is offered for use at the present time. Geological work on the south half of the belt is greatly hindered by the absence of topographic maps, and the United States Geological Survey should be requested to complete the field-work south of the Jackson quadrangle. The Survey should also, as soon as possible, give us monographs on both the Copper Belt and the Mother Lode.

The more important papers dealing with the Foothill Copper Belt are listed below.[1] Of these it is very unfortunate that the ones on Pine Hill and Copperopolis are the sole representatives of detailed work. The folios of the United States Geological Survey, with the exception of the Redding, merely note the existence of copper at a few points.[2]

Before discussing the immediate subject of this paper, I desire to call attention to a distinction between certain groups of geological facts relating to mining, a distinction that I believe should be made by mining geologists whenever possible. The complete set of facts about any mining property consists of two more or less well defined classes: (1) Those broad and fundamental relations between structure, rocks, and ore, the character of deposit, and so forth, that can readily be grasped and immediately used by the operative miner; and (2) those more minute and technical details of petrography, mineralogy, genesis of ore, and so forth, that, while ultimately vital to a full grasp of the deposit, are not at once necessary to the practical worker. If this clear distinction be always made, so that the non-scientific man be not confused by a wealth (to him) of unnecessary details, the recognition of the value of geology to mining will become more universal. This paper aims to present, as a preliminary study, some of the facts that are vitally necessary to a proper understanding and development of the copper belt, and which may readily be grasped and used by miner or prospector. Not only are these facts stated, but also the details proving them are presented.

[1] 'The Gold Deposits at Pine Hill, California.' A. J. S. 3rd series, Vol. XLIV, 1892. W. Lindgren.
'The Copper Resources of California.' Cal. State Min. Bur. Bulletin 23, 1902.
'Notes on the Foothill Copper Belt of the Sierra Nevada.' Univ. of Cal. Pub. Vol. 4, No. 17, 1906. A. Knopf.
'The Ore Deposits of Copperopolis, California.' *Economic Geology.* Vol. II, No. 4. John A. Reid.
'The Foothill Copper Belt of California.' *Engineering and Mining Journal* Nov. 16, 23, 30, 1907. Herbert Lang.

[2] The folios of the U. S. G. S. that cover any part of the foothill copper belt, from north to south, are: Smartsville, Sacramento, Placerville, Jackson, and Sonora. The Redding folio describes the deposits of Shasta county.

The foothill copper belt of the Sierra Nevada is a distinct part of the greater copper belt of California. It extends in a northwest-southeast direction along the foothills of the Sierra a few miles west of and parallel to the Mother Lode. The length is about 250 miles, reaching from Yuba county south into Fresno. Farther north the line of copper deposit turns northeastward into the summit region of the range. The important deposits of Shasta county are on the line of the foothill belt but separated from it by the Sacramento valley. South of Fresno county scattered copper ores are found, but our knowledge of them is very fragmentary. In fact, the information concerning the belt under discussion is yet so slight that it is impossible to formulate any broad generalization. Whether or not the belt posssesses unity as a province of any class, metallographic, petrographic, or structural, is yet to be settled. The general geologic features of the northern half are presented in the several folios of the United States Geological Survey. The southern half, which is probably the more important, is the one forming the main subject of this paper.

A few miles south of the Jackson quadrangle lie the important Copperopolis and Napoleon mines, with many promising properties near-by. About 25 miles southeast of the former place, the copper belt enters the west side of the Sonora quadrangle, the southwest corner of which it crosses. South of this area, in the region untouched by the Survey, lie the important mines of Mariposa and other southern counties. There are certain important geological conditions throughout the belt south of Campo Seco that tend to establish a definite unity within this portion of it. Further study will probably extend such unity to cover the whole. The important features to which I desire to call attention are as follows:

1. The foothill copper deposits occur in a struc-

Copperopolis, Looking Southeast.

The Gravestone Slates of the Copper Belt.

tural belt of which the most prominent feature is a weakness of the rocks. A complete investigation shows two rock-groups, distinct in time and physical characteristics. The earlier of these consists of the relatively abundant weak schists and slates; the later is composed of a series of massive igneous intrusives. Much variation in hardness exists in the earlier rocks, yet the belt as a whole is notable for the weakness of the component lithological units. More particularly, the older group embraces the various metamorphic tuffs and volcanics, now occurring as amphibolite schist, chlorite schist, meta-andesite, both schistose and massive, with all their variations, and the several facies of the Mariposa slates, from ordinary fissile black clay-slate to mica and andalusite schist. The ores occur at different places within all of them, irrespective of their exact petrographic and chemical nature. It is evident that, of the two possible factors governing ore deposition, the structural weakness of the rocks is the essential one, and that the precise characteristics of them as individual species is of secondary importance. At the same time, in the middle portion of the belt the physical qualities of the sedimentary and igneous schists appear to have exercised a differential control upon the basic intrusives responsible for the ore. These intrusives, and the connected ore deposits, follow the rocks of igneous origin, such as the meta-andesites, rather than the clay slates. In the southern part of the copper belt the mines are in schist derived from the Mariposa slate.

2. In the central part of the copper belt, from Campo Seco south to the Stanislaus river, there exist two lines of ore deposition, one following the east and the other the west side. The Campo Seco and Napoleon groups are on the west Copperopolis and the mines north of Littlehales are on the east.[3] Between these lies a broad belt of Mariposa slate, usually devoid of copper. These rocks are comparatively tough, and offer a greater resistance to igneous intrusions than the schistose tuffs and flows. A good example of this is found a few miles north of Copperopolis, where a serpentine dike has bowed and contorted a thin slate tongue but was unable to break through, though readily penetrating the adjacent schist. North of Campo Seco and south of the Stanislaus river it is yet uncertain whether or not the same conditions obtain. The two lines of deposit probably mark the places of maximum fracturing and igneous intrusions, and therefore of greatest ore deposition.

3. The structural weakness of the older slates and schists has been a feature of the range from early geological time to the present. The result of this has been the intrusion of a series of igneous rocks, with some of which ore deposition is connected. A glance at the Jackson and Sonora folios will show the distribution of the larger intrusive masses. There is a complex history of these, only a part of which is yet entirely clear. The whole series may be divided into two parts, upon a basis of time, petrographic, and structural relations. The earlier rocks are of plutonic habit, chemically basic or ultra-basic, and of very dark or black color. The grain is from fine to very coarse. They occur typically in long dike-like areas and true dikes, whose maximum extension is prevailingly parallel to the schistosity and therefore to the lines of greatest weakness of the pre-existing rocks. A few intrusions cross the foliation planes, but only under exceptional local conditions. The later intrusives are chemically acid, of both granitic and porphyritic habits, and usually of light color. The granitic rocks show few dike-like forms, but are commonly in rounded bosses and larger irregular domes having no orientation whatever to the surrounding schists or slates. A few rare granitic dikes do occur, as at Copperopolis. The porphyritic rocks, represented by quartz-porphyry in the copper belt, are always in dikes, and are few in number. The rounded forms of the acid plutonic are probably due chiefly to the viscosity of the acid magma and its inability to follow small openings. A weak belt of rocks may have become relatively stronger at the time of intrusion, due to compressive forces set up by larger masses of grano-diorite to the east. This would tend to prevent the formation of dikes, and may have been a real factor.

4. The massive igneous rocks are vitally important in the study of the copper deposits, as some of them are connected with the origin of the ores. These rocks, in order of relative age, are:

CLASS I.

1. Serpentine, from percolatite.
2. Pyroxenite and hornblendite, including some diabasic rocks.
3. Gabbro.

CLASS II.

4. Granite and granodiorite.
5. Quartz-porphyry.

The relative age of the last is yet uncertain. It is provisionally placed latest by reason of its possible relations to the acid plutonic.[4] It must not be confused with some older meta-rhyolite, that occurs in large amount in Gopher Ridge, at Campo Seco, and elsewhere in the meta-andesite formation. These older quartz-porphyries are among the earlier rocks of the copper belt. With the exception of a few yet obscure relations of the quartz-porphyry to adjacent rocks, from Campo Seco south the acid intrusives are distinctly later than the copper ore. Campo Seco itself has not been sufficiently studied by the writer to warrant any precise statements in this connection.

Of the first class of igneous intrusions, the serpentine is earlier than the copper ore, the gabbro later, and the hornblendite and diabase connected genetically with the deposits. The grano-diorite is later, but is in its turn related to deposits of auriferous pyrite in a quartz gangue. It is a probable condition that the gold-bearing quartz veins of the Mother Lode are connected with the acid plutonic intrusive.

[3] See Jackson Folio. U. S. G. S.

[4] The main argument for a later age of the quartz-porphyry is based upon its texture compared with that of the grano-diorite. The plutonic rock, now well exposed on the surface, crystallized from a molten condition at great depth; the quartz-porphyry solidified relatively near the surface. The two rocks now exist side by side, so that it becomes obvious that the porphyritic rock was intruded after the plutonic had cooled and much of the overlying material carried away by erosion. After a complete study of the intrusives the quartz-porphyry will undoubtedly be placed in a class by itself.

No deposits of ore undoubtedly associated with the quartz-porphyry are known to the writer.

5. The copper belt is characterized by a small amount of secondary ore, either oxidized or sulphide. The Pocohontas mine is an exception. Because of local fracturing and opening of the ground to vadose waters by an intrusion of grano-diorite, a zone of oxidized ore extends from the surface down for 90 ft., below which a small amount of secondary sulphides were formed. The causes of this condition of little oxidation are two. The easy erosion of the soft rocks of the belt has allowed the removal of surface ores at a comparatively rapid rate. Also, the tangential forces of compression present in the range have prevented the formation of an extensive vadose circulation, with resultant secondary ores. The second cause seems the more important. It is often the case, as at Copperopolis, that large bodies of original sulphide ore are capped by an inconspicuous gossan. The large bodies of nearly pure pyrite with low copper content have an extensive limonite cap, but such deposits are not typical of the belt.

6. Because the rocks containing the copper ore are foliated, the type of deposit consists of veinlets and stringers of the sulphides along the planes of schistosity. The aggregate of a particular group of ore stringers is commonly a lens or shoot. Not enough is known about the details of the great number of deposits to warrant a closer statement than this. At both Campo Seco and Copperopolis, as examples of comparatively well opened mines, the orebodies are usually called lenses, yet it is entirely possible that they are not lenses but true ore-shoots, reaching unbroken to a great depth. Some of the Mariposa county mines exhibit a different form. The Pocohontas ore is due to the metasomatic replacement of a basic dike and adjacent schist by sulphides of iron, copper, and zinc. The Great Northern mine near-by contains ore due both to a replacement of a basic dike and to the deposition of sulphide along the parting planes of the country. At the Cavan mine, a few miles south, the ore occurs as veinlets in the schist along the line of a basic intrusive, but the shallow workings are insufficient to show all the conditions of ore deposition. The essential point, in at least the south half of the copper belt, is the genetic relation of the ore to basic intrusives; the precise form of the orebody is of secondary importance.

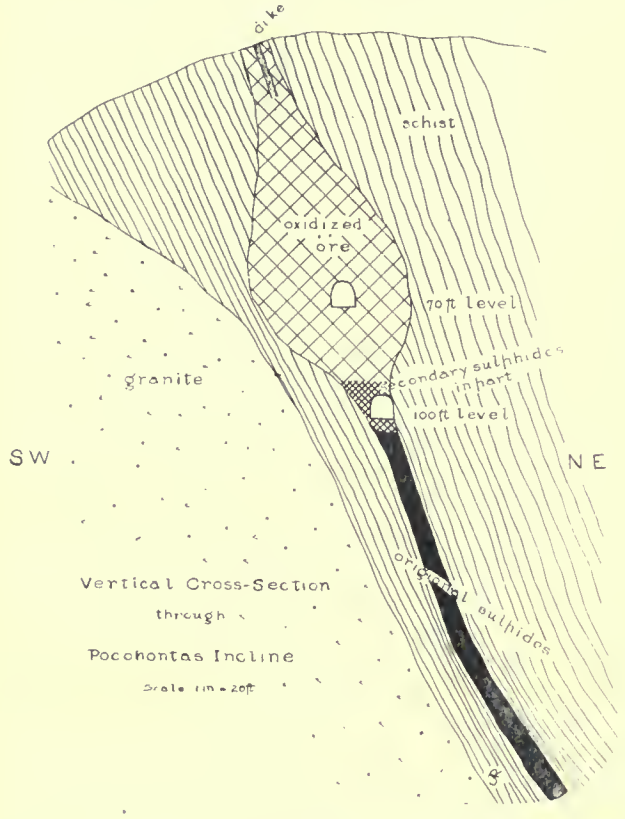
7. The question of depth is one always vital to the economic value of an ore deposit. Some of the irregular masses of low-grade pyrite of obscure origin have not kept their value with depth, but the mines exploiting deposits typical of the belt show no tendency to pinch out. The ore at Campo Seco has always varied as the workings have been extended, but the average tenor remains about the same. At Copperopolis the ore varies most in its physical condition; the change in copper content from top to bottom is little and irregular. Further, a winze sunk from the lowest level has cut a good body of high-grade chalcopyrite. This ore may be the apex of a new lens, or the downward prolongation of the ore-shoot above, displaced to the east by a nearly horizontal fault. The Napoleon shows good ore in the bottom. The comparatively shallow depths reached by the more southern mines have disclosed not a lessening in value, but rather a steady content of copper and little change in size of orebodies. None of the mine openings are yet of sufficient magnitude to bring to light any direct evidence beyond that already cited. Hence we are thrown upon a consideration of general geological relation for a more comprehensive view of the question. There is this to offer: The main mass of the ores are unaltered sulphides; they are connected genetically with deep-seated intrusives; the country rock, whose fissility often affects the ore deposition, maintains its character as a schist to great depths; the deepest mines on the Mother Lode show the schists and slates in their lowest workings identical with those on the surface. There is no reason, therefore, for expecting the copper ores to pinch out, but there are several good reasons for anticipating the existence of ore far below any point yet touched. Those large irregular masses of low-grade pyrite are excluded from these remarks, for the writer, of his own experience, knows nothing about them.

To illustrate the various statements made above, brief descriptions will be given of a few typical mines. Of these Copperopolis stands pre-eminent as a type in all details save the mineralogy of the ore.

Copperopolis.

The weak rocks of the copper belt at Copperopolis are embraced in the meta-andesite formation. The ore occurs as lenses or shoots in a chlorite schist, a local modification of the rock-mass. Intruded into the earlier formation are serpentine, hornblendite, gabbro, and grano-diorite. The serpentine, including talc, often framing the west wall of the ore zone, is older than the ore, as seams and films of the sulphides are found along the gliding planes within it. The hornblende is always within the ore-bearing schist and contains chalcopyrite as an original constituent. Its physical appearance indicates that it has undergone about as much compression as the ore. The gabbro, occurring only in one small boss, appears later than the ore, as it cuts directly across the main line of deposit but contains no traces of copper. It also fails to show the results of as great compression as that experienced by the ore and hornblendite. The grano-diorite occurs as a series of tongues and larger masses intruded into the ore zone, in which it has caused both physical and chemical changes. In those parts of the Union mine best opened the seams of ore have been displaced by a great number of small faults dipping gently to the east. Each individual fault is characterized by a shifting of the foot-wall a few inches to the east; the nature of the movement is therefore that of a direct thrust, with the peculiarity that the foot-wall and not the hanging wall has been moved by the active force. This series of small movements is due to the lateral pressure caused by the intrusion of a tongue of grano-diorite. The accompanying photograph illustrates this feature. Other faults also are necessary in the complete dynamics of these intrusions, and they are not rare.

Such faults are found crossing the schist nearly at right angles to the strike, with nearly vertical dip, and with their movement depending upon the position of the intrusive tongue. That wall of each of these faults that lies nearest the grano-diorite has moved outward, or eastward, as the rocks are actually placed. A few of these dislocations are shown in the photograph. The general effect upon the ore



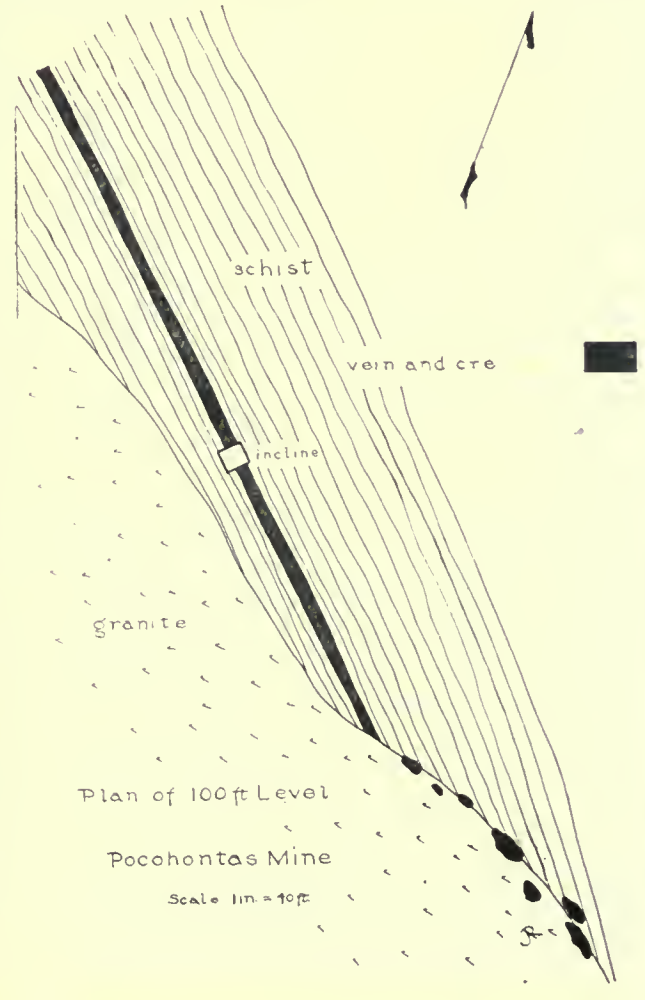
has been to decrease the angle of dip of the ore-shoot, while that of the individual seams has not been altered. The chemical effect of the acid intrusive is no less marked. The normal ore is noted for its lack of free silica and with sulphides in sharply defined seams. Where the grano-diorite has pushed its way into the ore the chalcopyrite has been recrystallized into irregular grains and masses in a gangue of quartz, calcite, and chlorite of different grain from that of the original schist. A photograph shows the top of a tongue of the plutonic with the ore seams curved around its periphery. The ore directly on the tongue is much silicified; that a few inches away less so; that a foot distant is little altered except where cut by quartz veinlets. Much pyrite with not a trace of copper is present within the body of the tongue. The metal is present near the outer limits of the intrusion, where some absorption of ore has occurred. The fact that pyrite is present as an original constituent in the upper portions of the grano-diorite is important. This mineral is dissimilar to that associated with the chalcopyrite, as it contains gold but not copper. It is present chiefly in the upper parts of the intrusive tongues, which are also more silicious than the normal phase of the rock. Veinlets of quartz, and quartz with feldspar, project upward from the intrusion into the adjacent schist and ore. Quartz-calcite veins also are found on another part of the mining ground. The upper portions of the granitic magma were thus rich in silica, carbon dioxide, vapors containing some form of sulphur, probably hydrogen sulphide, and gold, but no copper in appreciable quantity. Elsewhere on the surface over known intrusions of the acid rock there are found veins and irregular masses of auriferous pyrite with quartz. Such pyrite is usually coarsely crystalline and different in appearance from the same mineral as found in the copper ore. For full particulars on Copperopolis the reader is referred to the larger paper.[5]

Pocohontas.

This group of mines is situated in Mariposa county near Lewis postoffice, east of Merced. There are several important features of the copper belt exhibited by these deposits. The prevailing rock is andalusite schist, of the Mariposa slate formation. It is intruded by basic and acid plutonics, the petrography of which is not yet worked out, nor is it essential to the needs of the present paper. The basic rocks appear to be both diabasic and ultrabasic, with possible gradations. The acid rocks have but the one usual representative, a granitic one, which will here be referred to as granite.

The chief properties are the Pocohontas and Great Northern. Across the land owned by the present company there are three well defined lines of basic igneous intrusions. Others occur still farther west. On the east line lies the Pocohontas; on the west about a mile distant lies the Great Northern. The middle line shows no ore at this place, as the covering of alluvium masks the rocks, but along its southward extension ore is found. At the Pocohontas the

5 'The Ore Deposits of Copperopolis, California.' *Economic Geology.* Vol. II, No. 4, 1907.



schists strike almost northwest and southeast, dipping about 70° east. Intruded along the cleavage planes is a narrow dike of rock much like a diabase in hand specimens yet having the appearance of a hornblendite in some coarser grained facies taken from the surface. Below the 100-ft. level the ore is in its original condition and shows 4 ft. of practically solid sulphides between clean schist walls. The ore has metasomatically replaced the dike and some schist. The actual thickness of the dike is yet undetermined, as material clearly recognizable as such is found only with the gossan on the surface. Above the 100-ft. level the sulphides are present for 10 ft., on top of which is a large body of carbonate and silicate of copper. There is a maximum width of perhaps 40 ft. of this material at the 70-ft. level, though not more than 20 ft. is workable ore. The oxidized body narrows toward the surface, where comparatively few stringers of green ore in an iron-stained schist indicate the presence of the deposit. Below the 100-ft. level in the shaft the vein descends in a uniform manner, both in respect to copper content and size. The dip changes somewhat, due to the pressure exerted by the intrusive granite. The section presents these features. On the level to the north no particular change in the vein occurs; to the south for 100 ft. from the shaft some secondary sulphides are present to a depth of 140 ft. Farther south the vein and ore are cut off by the granite. The granite-schist contact here strikes about west-northwest, but varies at different points. South of the end of the unbroken vein are found bunches of ore scattered along the contact of granite and schist, some of which have considerable value. It is these occurrences that have caused the belief that the main orebody is a contact deposit. The section shows this condition. The ore is a mixture of chalcopyrite, pyrite, sphalerite, and possibly a little pyrrhotite, with some gold.

The Great Northern mine is situated on a deposit similar to that of the Pocohontas, but differing from it in a few noteworthy particulars. A dike of ultrabasic rock occurs within the boundaries of the ore zone. It is a hornblendite or closely allied species, but is now so altered by the vein solutions that a precise determination is yet to be made. The ore is partly the metasomatic replacement of the dike and in part consists of veinlets and seams along the foliation planes of the adjacent schists. Nearly 40 ft. of schist is ore-bearing. The entire substance of the intrusive is not replaced, and the part remaining has not been reduced to an aggregate of radial bunches of a light colored amphibole in which the sulphides occur both finely disseminated and in larger discrete masses. In addition to the sulphides noted in the Pocohontas vein, arsenopyrite also is found in the altered amphibolitic dike. The ore in the schist shows little or no arsenical minerals.

The large granite intrusion that crosses this part of Mariposa county in a general east-west direction lies to the south of the Great Northern. South of the granite the copper belt continues and contains many promising properties. The Cavan mine lies about four miles south of the Pocohontas and shows similar conditions of ore deposition. The deepest workings of these mines are but a few hundred feet, and much development work is needed.

It is an interesting fact that at one other locality a granite intrusion cuts across the copper belt. The large area of this rock east of Sacramento lies within the boundaries of the belt, and has undoubtedly acted upon the copper deposits of that immediate region as it has done farther south.

Conclusions.

The conclusions to be drawn from the facts presented in this paper are not many, but they are important:

The foothill copper belt is one of weak schistose rocks whose precise composition is of secondary importance to their general weakness. Into them have been intruded at different times a series of igneous rocks of two main classes. The first consists of basic plutonics of different ages: the second is chiefly acid grano-diorite or granite. In the first class, hornblendite and allied species are genetically connected with the copper ore: the acid rocks are related to later deposits of auriferous pyrite and gold-quartz veins. The basic rocks are typically in dikes or dike-like forms intruded into the schist parallel to the line of maximum weakness. Hence the copper orebodies strike with the country rock and consist of veins, lens-shaped deposits, or ore-shoots in the schist. The ore consists essentially of original sulphides, little secondary material having been formed. A gossan is always present, but a small limonite capping does not necessarily mean a small body of ore below. The depth of the orebodies is unknown, but is probably great. The belt as a whole is badly in need of intelligent prospecting and mine development.

The ores of the Goldfield district in Nevada occur in the form of masses of shattered, altered rock of very irregular shape. The common gangue of the unoxidized ore is compact, almost flinty, quartz which in most cases has resulted from the silicification of dacite, rhyolite or andesite. Associated with the quartz in much of the ore are soft white substances which in most cases are either alunite or kaolinite or a mixture of the two. These are commonly called 'talc' by the miners. The ore contains pyrite, bismuthinite, native gold, and a brownish copper-bearing mineral having the general composition of tetrahedrite. Chemical analyses nearly all show a little tellurium and a small speck of sphalerite has been found in the Goldfield-Belmont ore. The best ore is characterized by concentric shells of ore minerals about greatly altered rock-fragments. An inner zone of free gold and quartz up to an eighth of an inch in thickness may be covered by a shell of tetrahedrite and this by an outer crust of pyrite. In the Florence mine similar fragments show first a shell of pyrite, then one of tetrahedrite, and finally a thick crust of quartz with native gold, tetrahedrite, and pyrite, and transfixed by needles of bismuthinite.

SIMPLE PROBLEMS IN AIR-COMPRESSION.

Contributed to the MINING AND SCIENTIFIC PRESS
By EDWARD A. RIX.

*Before we undertake to solve the problem that I shall present for your consideration, I shall give you some of the practical data on which my calculations are based.

During the last twenty years, I have kept a log of all the compressed-air plants I have tested, and also the actual performances of a great number, covering almost every kind of compressor and compressed-air motor or tool, and I have averaged all the indicator-cards taken from the various compressors used in mining work and compared the indicated horse-power with the actual power required, comparing this with the displacement of the compressed cylinders, I have concluded that for a safe and sane power factor, we must allow 20 hp. for every 100 cu. ft. of cylinder-displacement, to compress air from atmospheric pressure to 90 or 95 lb. receiver gauge-pressure at sea-level.

I have made my calculations on these pressures because they are the standard pressures now used for pneumatic work, and nearly every machine and motor is constructed for these pressures. Twenty horse-power means the power delivered at the shaft of the prime mover.

If you consult tables in any engineering magazine or trade catalogue on air-compressors, you will note that the power claimed to do certain work is much less than the figure which I give you, and in explanation it must be noted that these tables are theoretical, and do not take into account the mechanical efficiency of the compressor, nor losses due to volumetric efficiency of compressors. These figures are therefore misleading and should be avoided except in comparisons between one machine and another.

It is most unfortunate that the public is not given the results of working tests upon plants of all descriptions running under ordinary conditions, as such information is much more valuable than the records of official tests, which are usually made under special conditions by experts at the most satisfactory load—a set of conditions not often realized.

You must have a safe margin in your calculations, so that neither you nor those for whom you are installing a plant will be disappointed, and I therefore have given you 20 hp. per 100 cu. ft. of cylinder displacement as a figure that will never get you into trouble, and at the same time, it is not too generous. It may also be noted that it would be just as well in small plants to make no distinction between single and two-stage machines. By small plants, I mean up to 400 cu. ft. capacity.

Second: Remember that a compressed-air cylinder will never give a quantity of air equal to the volume swept by the piston, for the reason that such things as clearance, leakage, temperature, piston speed, etc., reduce the theoretical quantity so that it is best to estimate about 80% volumetric efficiency for the average mining compressor. Many do not give 60%, and some 90 per cent.

*An address delivered before the Mining Association of the University of California.

Third: In using compressed air at 90 lb. pressure cold, it will take 24 cu. ft. free air per minute to give one horse-power in plain slide-valve engines and 15 cu. ft. with good expansion-valve gearing; and between these two limits will lie all the various types of engines. If the air be re-heated, to about 300° F, it will reduce the above quantities about one-third. In one hoisting engine which I installed, having compound Corliss cylinders and where the air was heated to 400° F before entering each cylinder, it required between 7 and 8 cu. ft. only for one horse-power. Most mines, however, use cold air and prefer the power-loss to the trouble and expense of the installation and maintenance of re-heating apparatus.

Fourth: The tables set forth in the trade catalogues for the air-consumption of standard piston rock-drills are fairly accurate and are generally in terms of the compressor-cylinder displacement.

Fifth: For operating ordinary station and sinking pumps of the direct-acting type, which is the ordinary stock pump used in mining operations, it will be safe for you to calculate that one cubic foot of free air compressed to 90 lb. gauge-pressure will do 135 foot-gallons of pumping.

Sixth: Ordinary mining hoists have a mechanical efficiency of about 75 per cent.

Seventh: For the determination of sizes of pipe, losses of pressure, and terminal pressures for compressed-air transmission, I use the Johnson formula, which is:

$$P_1^2 - P_2^2 = \frac{0.0006 V^2 L}{A^5}$$

wherein P_1 = absolute initial air-pressure.
P_2 = absolute terminal air-pressure.
V = free air equivalent passing through the pipe.
L = length of pipe in feet.
A = diameter in inches.

This formula is quite simple to solve.

With these facts at hand, we can now readily calculate the problem to be considered, which is:

Problem.—Given a water-power distant 5000 ft. from a mine, it is desired to generate compressed air and transmit it to the collar of the shaft for operating purposes. The work to be performed is as follows:

One hundred tons of ore and waste to be hoisted in 20 hours.

Thirty gallons of water per minute to be pumped, either at a station or a sinking-pump.

Five 2¼-in. standard piston rock-drills to be operated.

Three air-hammer drills to be operated.

General Conditions:

Depth of shaft, 600 ft.
Weight of skip and rope, 1000 lb.
Weight of ore hoisted, 1 ton.
Initial air-pressure, 95 lb.
Final air-pressure, 90 lb.
Altitude, sea-level.
Geared hoist and unbalanced hoisting.

Required:

Size of compressor.
Diameter of air-pipe.
Brake horse-power.
Altitude factors.
Re-heating coefficients.

Note: In problems of this kind, we must reduce all of our requirements to cubic feet of free air, because free air is the basis for all power calculations.

To determine the free air required for hoisting: If 100 tons of ore and waste are to be hoisted in 20 hours, the hoisting will be done at the rate of 5 tons per hour, and as each load hoisted contains one ton, it follows that there will be a load hoisted every 12 minutes. Of course, we know that an absolute schedule of 12 minutes between hoists can scarcely ever be carried out, for the intervals may be shorter during one hour and longer during another, or stop altogether, but the only way to figure it, is on a regular basis, and after that is determined, allowance one way or another can be made for any irregularity.

The load being 2000 lb. of material and 1000 lb. of rope and skip, makes a total of 3000 lb. which is to be hoisted 600 ft. This 3000 lb. lifted 600 ft. will require 1,800,000 foot-pounds of work, or 54 hp. theoretical. Since the hoist has a probable efficiency of 75%, the 54 hp. theoretical becomes 72 brake-power actually required.

Using cold air, it requires, as we have mentioned before, 24 cu. ft. free air per horse-power. Then $24 \times 72 = 1728$ cu. ft. of free air, which the hoist will consume to make one lift. This, you will note, gives us direct results without taking into consideration the element of time or the dimensions of the hoist. If we made a hoist every 12 minutes and it required 1728 cu. ft. to make a hoist, then the compressor must furnish 144 cu. ft. free air per minute continuously, and we must have storage capacity sufficient to accumulate the air between hoists. Right here is the vital point of hoisting economically with compressed air.

Let us assume in our problem that we hoist at the rate of 300 ft. per min.: then it will take 2 minutes to make the lift, and the hoist will be lowering and idle during the next 10 minutes. During this 10 minutes the compressor is delivering 144 cu. ft. free air per min., or 1440 cu. ft. total, which must be stored.

If the hoist is none too large for the work, you will find that if the pressure in the receiver drops more than one atmosphere, or from 90 to 75 lb., the hoist will not operate in a satisfactory manner. Then, in our problem, if we must draw 1440 cu. ft. from the receivers at a drop of one atmosphere in pressure, the receivers must have a capacity of 1440 cu ft., and if the hoist is amply large so that it will still operate after the receiver pressure has dropped two atmospheres, or from 90 to 60 lb., then the receiver capacity can be one-half of 1440 or 720 cu. ft.; but it is not wise to go below this pressure, because it will affect too materially the pressure required for operating the other machinery.

For first-class work, install receivers having a capacity equal to the storage required at one atmosphere pressure. Large receivers cost less in proportion to their storage capacity than small ones; for example, a carload consisting of four receivers 54 in. diam. by 30 ft. long, containing about 2000 cu. ft., costs at the present time about $1600, while the same storage in ordinary receivers 48 in. diam. and 12 ft. long would cost about $2200. It is better to invest more money in receivers and less in compressors, because the smaller compressor takes less power at the peak, and most power bills are figured on a constant peak.

If you install a plant and the receiver capacity is too small, you can always determine the proper quantity of storage by running the compressor with the unloader cut out, and if the receivers blow off between hoists and the pressure drops more than 15 lb. during hoisting, add more receiver capacity until it will not blow off nor drop more than 15 lb. If you arrive at the point where it does not blow off and the pressure does not fall 15 lb., then slow down the compressor until the desired drop is reached, and you will be operating your plant at the most economical point. Then cut in the unloader again and let it work when it will. An unloader only saves wear and tear on the compressor where you buy power at the peak load, as happens in most cases, but does not affect your power bill.

Let us go back to our problem. We have found that 144 cu. ft. per min. is required for hoisting. Now, while we have allowed 4 hours in 24, or 1 hr. 20 min. on each shift, for hoisting and lowering men, timbers, supplies, etc., it is entirely probable that at least once every hour someone will be going up and down the shaft, and it would be practical therefore to say that the hoist would handle 6 loads per hour, instead of 5, and we must therefore add 20% to the hoisting requirement, making say 175 cu. ft., instead of 144.

To determine the amount of compressed air required for pumping: For pumping 30 gallons per minute 600 ft., requires 30×600, or 18,000 foot-gallons of work. If one cubic foot of free air at 90 lb. gauge-pressure will give 135 ft.-gal., we shall require 133 cu. ft. free air for the pumping. This requirement is constant.

To determine the amount of compressed air required for drilling: Five 2¼-in. rock-drills will require 50 ft. free air each, or 250 cu. ft., and three air-hammer drills will require 25 cu. ft. each, or 75 cu. ft. To get these amounts, take about 80% of the requirements as stated in rock-drill catalogues, which always give quantities in compressor-cylinder displacement, which do not deliver on an average within 20% of their displacement, except in large machines.

Our total requirements will therefore be:

Work.	Cubic feet.
Hoisting	175
Pumping	133
Drilling	325
Total	633

This 633 cu. ft. does not take into consideration any ordinary pipe-leakage in the hoisting works and below ground. In conducting this air from a distance, for our problem calls for a transmission of 5000 ft., it would be well to allow for a leakage of 5% on the entire system. This would bring our requirement up to 665 cu. ft, and if we allow that our compressor will give a volumetric efficiency of at least 80%, we must have a cylinder displacement of 830 cu. ft. per minute.

You will remember that our power factor was 20 hp. per 100 cu. ft.; consequently we must have 166 hp. delivered on our water-wheel shaft to drive this compressor.

Finally, we must determine the size of the pipe, allowing 5 lb. drop in pressure for loss by friction. You will remember the formula:

$$P_1^2 - P_2^2 = \frac{0.0006 V^2 L}{A^5}$$

P_1 the initial pressure absolute $= 95 + 14.7$, or 109.7, and its square is 12034.

P_2, the terminal pressure, we have stated shall be 5 lb. less than the initial, or 90 lb., or 104.7 absolute, and its square is 10962.

The difference between these two or

$$P_1^2 - P_2^2 = 1072.$$

Substituting this in our equation, and also the values for L and V, we have

$$1072 = \frac{6 \times 5000 \times 633 \times 633}{10{,}000 \times A^5}$$

Reducing, we have $1072 \times A^5 = 3 \times 633^2$, or

$$A^5 = 1121$$

$$A = 4\text{-in. pipe.}$$

We have now to figure the size of the compressor required. If you happen to have tables and catalogues at hand, it will be an easy matter to look up a satisfactory compressor having a displacement of 830 cu. ft., but if such literature is not at hand, the size of the compressor may be determined as follows:

It almost goes without saying that you would select a two-stage compressor for anything over 400 cu. ft. capacity. This two-stage compressor will have a low-pressure or gathering cylinder, wherein the air is compressed to about 25 lb., and a high-pressure cylinder, where the air at 25 lb., after it has been cooled, will be compressed to 90 or 95 lb. pressure. The reason a two-stage machine is selected is because it has a higher volumetric efficiency, requires less power to operate it, is easier to lubricate on account of lower temperatures, and has less strains on the mechanism.

The first thing to consider is the speed at which you will operate the compressor, and this will be dictated by many things. If you have a limited amount to expend, you will naturally select as high a working speed as possible, because the higher the speed, the smaller the compressor. Again, you may have to take the future into consideration, and you may want more air when the shaft goes deeper or more water is encountered. You would then naturally select such a speed as would give you the margin of additional power required.

You may take 150 r.p.m. as the maximum for compressors from 400 to 1500 ft. capacity, and 100 r.p.m. as a speed that will give you a 50% margin for the future, so let us assume that the mine in question has a future, and take 100 r.p.m. If our requirement is 830 cu. ft. per min. we shall then require an intake or compression cylinder that will give us 8.3 cu. ft. per revolution, and inasmuch as the cylinder is double-acting, that is, makes two displacements per revolution, the cylinder must have a capacity of 4.15 cubic feet.

Experience dictates that the average compressor-cylinder is built for the following strokes and capacities:

Stroke in inches.	Capacity in feet.
6	up to 50
8	" 100
10	" 200
12	" 500
16	" 700
18	" 1500
24	" 2500

Our compressor will therefore be best suited by an 18-in. stroke, or 1.5 ft. If the capacity is 4.15 cu. ft. and the stroke 1.5 ft., the area of the cylinder will be: $4.15 \div 1.5 = 2.75$ sq. ft., or 397 sq. in., which is the area of a 22½-in. cylinder. The low-pressure cylinder will therefore be 22½ by 18 inches.

It is evident that if we have two cylinders to do our compressing, there is no good reason why one cylinder should do more work than the other, and there is a very good reason why the work performed by these cylinders should be equal, namely, because the total work and temperature developed will be at a minimum. As an explanation would lead us into mathematics, you must take the statement as a fact. There is also the mechanical reason that the strains on the machine will be at a minimum, and if you construct the compressor of the duplex type, both sides will be alike except as to the cylinders. It can be shown easily by algebraic method that if our two cylinders perform equal work, the intermediate pressure must be a mean proportional between the initial absolute pressure and the final absolute pressure, and the cylinder ratios will be as the ratios of either the high or initial absolute pressure to the intermediate. In other words, to put this in such shape that you will easily remember it:

If P = absolute initial pressure
P_1 = absolute intermediate pressure
P_{11} = absolute final pressure

then $P_1 = \sqrt{P \times P_{11}}$

Take our example: Our initial pressure is atmospheric or 14.7 lb. absolute. Our final pressure is 95 lb. gauge or 109.7 absolute. The intermediate pressure will then be $P_1 = \sqrt{14.7 \times 109.7}$, or 40 lb. absolute, or 25.3 gauge pressure. Our proportion then stands thus: 14.7 : 40 :: 40 : 109.7, which represents a ratio of $40 \div 14.7$, or $109.7 \div 40 = 2.74$.

The cylinder ratios will therefore be identical with the pressure ratios, and our high-pressure cylinder will have a capacity of $1 \div 2.74$ of the low pressure. The strokes being the same, the area of the high-pressure cylinder will be $1 \div 2.74$ of the low-pressure, which was 397 sq. in. Dividing this by 2.74, we

have 145 sq. in. as the area of the high-pressure cylinder. This corresponds to a diameter of 13½ in. The compressor will then be a 22½ by 13½ in. with 18-in. stroke, and you will be justified in taking the nearest size to this that the manufacturers can supply.

You will note that as the altitude increases, the initial absolute pressure diminishes, and as the final pressure remains the same, the pressure-ratio grows larger as the altitude increases. For example: at 10,000 ft. the atmospheric pressure is 10 lb. instead of 14.7 lb., and if you go through the same calculations that we have just made, you will find that the cylinder-ratios will be 3.3 instead of 2.74, and this will make the high-pressure cylinder only 12½ in. diam., instead of 13½ diam., and the intermediate pressure will be 18.3 lb. instead of 25.3 lb. Such a compressor would not, however, be able to do the work contemplated in the problem considered, for the reason that while the weight of air necessary to do work remains practically the same for reasonable altitudes, the capacity of the compressor diminishes as the altitude increases. It is true the volume remains the same, but it has not the weight, and therefore you must increase the size of the cylinder required at sea-level by the ratio between the ratio of compression at sea-level and the ratio of compression at altitude.

In our problem, the ratio of compression at sea-level is 7.5, and the ratio of compression at altitude of 10,000 ft. is 11. The sea-level compressor must be increased therefore 11 ÷ 7.5, or 1.47 times, to give the same weight of compressed air at 10,000 ft. altitude, or to put it even more simply, it will take 11 strokes of the same sized compressor piston at 10,000 ft. altitude to give the same compressed air or to do the work that 7½ strokes will do at sea-level. In our problem this would make a low-pressure cylinder of 27 in. instead of 22½ in., and a high-pressure cylinder of 15 instead of 13½ in. In other words, this altitude compressor must be nearly 50% larger to do the same work.

A proper understanding of these simple calculations will enable you to check compressor sizes and proportions, and no one could furnish you with a sea-level compressor for an altitude, nor the reverse. We have assumed 80% volumetric efficiency in this problem, but if the compressor happens to be a slow-speed mechanical-valve machine, 90% could be assumed. The figures I have given are safe and taken from average plants, and it will be necessary for you to use your judgment in assuming a higher or lower factor.

To determine the amount of compressed air required for re-heating: It is practical to re-heat air from 300 to 400°F in various ways, and great economy is realized, especially for pumping and hoisting, and if it is possible you may reduce the quantities of cold air that we have figured for this character of work by the ratio of the atmospheric to the compressed-air temperatures absolute. Thus, if the atmosphere is at 60°F or 520° absolute, and the compressed air is used at 300°F or 760° absolute, then the volume of cold air for your work may be taken at the ratio of 520 ÷ 760, or about 70%, thus making a saving of 30 per cent.

In conclusion, let me caution you about being led astray by the will-o'-the-wisp 'efficiency' when you come to choose between compressed air and some other power to do mining work. 'Utility' should always be the standard for comparison. It is seldom that any set of conditions calls for the exclusive use of one kind of power, and it is not good engineering to make an installation the victim of any fad or prejudice. Whether it be steam, electricity, water-power, or compressed air, or a combination of any or all of them, let the sole and only qualification be determined on the basis of commercial efficiency.

The precipitation room of the cyanide plant at the Portland mine, Colorado, contains 18 rows of zinc boxes, each row having six compartments 4 by 4 by 4 ft. and pyramidal in shape at the bottom. A 14-mesh wire screen supported by a 2-in. angle iron riveted on the inside, 20 in. above the lowest point of the pyramid forms the false bottom. These boxes are supported on timbers high enough above the cement floor to permit a man to stand up to work about them. The solution enters the first box through a false compartment, flows under the screen, then up through the zinc and over into the next compartment; 28 in. is the distance from the screen to the overflow of each compartment. A 12 by 12 in. wooden launder beneath each row of boxes carries the discharge to a launder of the same dimensions, which discharges into a steel vat with capacity for holding all of the solution from one row of zinc-boxes during a clean-up. It is connected to a 2-in. centrifugal pump which lifts the contents 30 ft. to a lead-lined tank. A hood having a 12 by 12-in. opening in the centre for the escaping fumes during a clean-up is built over the tank. Twelve sets of zinc-boxes are in use; each compartment is packed with 200 lb. of zinc shavings previously dipped in a 2% acetate of lead solution. Strong solution having 0.6 lb. cyanide per ton and a protective alkalinity 0.5 to 1.0 lb. flows through six rows of boxes, and a weak solution—the strength of cyanide per ton of solution being 0.3 to 0.4 lb. and protective alkalinity, neutral to 0.2 lb.—flows through the other six boxes.

In Central America the high-water mark is difficult to determine in the rivers, owing to the dense growth which covers the valleys between the periods of flood. These usually occur at intervals of 6 or 8 years. Trees more than a foot in diameter will grow up in this period, and the only sure test is to find the limit of the growth of hardwood. The floods carry everything before them, when they occur, and all vegetation is uprooted.

The Suffioni or hot springs of Tuscany emit steam at 110° C, which has never been utilized for power owing to the corrosive substances in the vapor. An attempt is being made to overcome the difficulty and utilize this great natural supply of power for generating electricity.

CENTRAL NEVADA.

Written for the MINING AND SCIENTIFIC PRESS
By A. H. ELFTMAN.

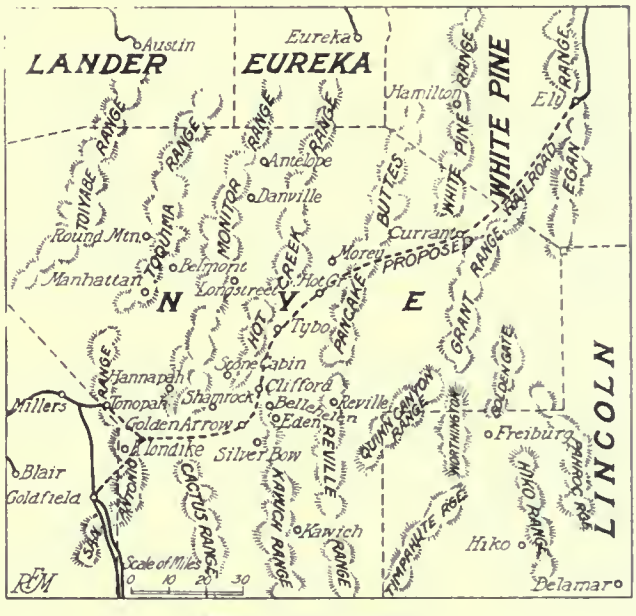
The increased activity in the development of the mineral resources of Nevada, and the projected railroad from Ely to Goldfield and Tonopah, is directing attention toward the camps of central Nevada, the progress of which has hitherto been retarded by the lack of transportation facilities. Desultory exploration in this region has proved the existence of numerous prospects warranting development even under the present adverse conditions. Indeed, several mines have been tested to a depth of several hundred feet, and many other properties show that they would be paying mines if operated under conditions similar to those found in districts favored with railroads.

A glance at the map of Nevada shows that Ely, being the acknowledged smelter centre of the State, has commercial interests that demand a short line of railroad to the southern Nevada camps if a practicable route can be found. The present distance from Goldfield to Ely by railroad is 730 miles, over three separate railroads, necessitating transfers at Mina, Hazen, and Cobre. A railroad direct from Ely to Goldfield would be about 175 miles long, or only one-fourth the present distance. The accompanying map, comprising an area 150 miles square, shows the position of the towns, railroads, and mountain ranges of the central part of the State. This region is traversed by a number of high ranges whose main axis is nearly north and south. Between the Southern Pacific railroad in the north and the Clark railroad in the south there is only one pass that is feasible for a railroad across the central part of the State. This is the Clifford or Warm Springs pass, separating the Kawich range from the Hot Creek range. The whole route is very favorable to the construction of a railroad. Leaving Goldfield at an altitude of 5700 ft. the first 12 miles would drop 400 ft. to the Ralston valley, which is nearly level at an altitude of 5300 ft. for 25 miles to the western slope of the Kawich mountains. The next 30 miles rise to 6300 ft. at the Clifford pass. The following 25 miles drop about 500 ft., and the remaining 80 miles varies from 5500 to 6400 ft. at Ely. The most difficult feature of the road is the outlet across the Egan range at Ely.

The first mining district encountered is that of Kawich, from 50 to 75 miles east of Goldfield. This comprises the camps of Golden Arrow, Silver Bow, Horseshoe, Bellehelen, Clifford, and Eden, situated around the north end of the Kawich mountains. Of these Golden Arrow is the most developed, and from its favorable site is likely to be the distributing centre for the Kawich country. The deepest mine, at Golden Arrow, is down 230 ft., with large veins of good ore. Water was encountered at a vertical depth of 175 ft., thus assuring a sufficient supply for all purposes. Other mines are securing equally favorable results with depth. The camp is now 45 miles distant from Tonopah. Silver Bow is 15 miles southeast of Golden Arrow and 60 miles from Tonopah. There are two mines that can ship ore at a profit at the present distance.

Bellehelen and Clifford, respectively 8 and 15 miles northeast of Golden Arrow, and both 52 miles from Tonopah, have several mines developed to a depth of over 100 ft., exposing large bodies of milling ore. The ores of the Kawich camps are silicious, carrying gold and silver.

The next important mining country is that around Hot Creek, which is 25 miles northward. This comprises the camps of Tybo, Hot Creek, and Morey, all of which were thriving producers twenty years ago, and now have a large tonnage of ore ready for shipment as soon as a railroad is built. The ores are base, carrying copper and lead, with silver and gold. About 50 miles east of Hot Creek is Currant Creek, which will serve as an outfitting point for the



Map of Central Nevada.

development of the numerous prospects in the Grant range, and now wholly neglected. North of Currant is the Duckwater district.

The country from Currant to Ely is being developed from Ely. Several other camps will be tributary to points on the new line. The camps of Longstreet, Danville, and Morey will be nearest to Hot Creek. Reveille, an old producer, now 70 miles from a railroad, will be within 20 miles of the new road. Golden Arrow will have as its tributaries, Shamrock, a promising copper camp in the south end of the Monitor range and eight miles west, and Kawich or Gold Reed, now 75 miles from a railroad, which will be only 30 miles from Golden Arrow.

Central Nevada, from the Kawich range eastward, is well supplied with timber and water, and with improved transportation mining operations can be conducted much cheaper than at Goldfield or Tonopah. The direct benefit derived from this railroad by southern Nevada will be a new opening for its ores, reduced freight rates, and direct connection with what will be virtually an independent transcontinental line, consisting of the Tonopah & Tidewater, Tonopah & Goldfield, Ely & Goldfield railroads, and the Nevada Northern, connecting with the Western Pacific.

SUSPENDED IRON FRAME VANNER.

By Grant B. Shipley.

It will be noticed that this new machine (recently placed on the market by the Allis-Chalmers Co. of Milwaukee) is constructed of iron and steel, excepting the pulp distributor, which is of wood. In the regular vanner, as ordinarily constructed, the frame is supported on each side by rectangular steel bars, spaced an equal distance apart, and the resulting side shake or stroke is in a horizontal plane. In the iron frame suspended vanner, the frame is hung from two rods on each side, which are so arranged that the side shake imparts a peculiar motion to the belt, the longitudinal centre line remaining stationary in its vertical plane while the sides are alternately raised and lowered in their vertical planes, thus causing a panning effect so desirable in the concentration of finely crushed materials. This motion has the effect of not only settling and separating the mineral from the pulp, but it prevents the formation of sand corners, along the sides of the belt, which diminish the capacity of the machine and cause the pulp to slop over onto the working parts. The particular features of this machine are as follows:

The peculiar motion imparted by the side shake.

The adjustable side-shake motion regulated by the eccentrics.

The combined cone pulley belt-tightener and adjustable support.

The adjustable gate on each pipe of the water distributor.

The independent adjustment at the four columns for regulating grade of belt.

The universal drive for worm and worm-wheel on the head roller.

The shaking frame, built entirely of steel.

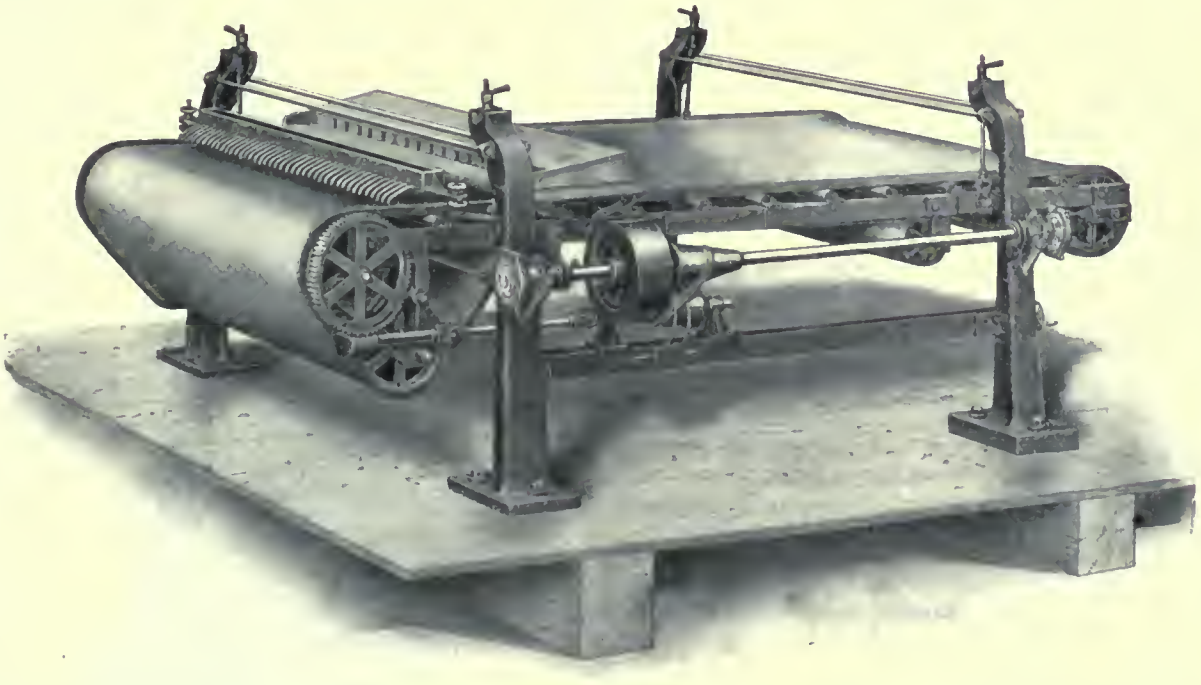
The perfect access to all adjustments and clear space underneath machine.

The driving power is applied through a belt from the overhead counter-shaft to the combined flywheel and pulley, which in turn transmits its energy to the main shaft running parallel to the length of machine, on each end of which there is secured an adjustable eccentric for giving the side shake to the frame. Adjacent to the main pulley, on this shaft, a cone-pulley is located that drives a similar pulley, on the worm-shaft, through a belt. These two cone-pulleys are for the purpose of giving the worm-shaft a wide range of speed, the worm transferring to the worm-wheel the desired speed for driving the head-roll.

In order that there shall be no slippage on the cone driving belt, a practical arrangement is incorporated consisting of a steel frame, adjustably supported on the rear column and guided on the front columns so that it acts as a floating belt-tightener, as well as a support for the worm-shaft and cone-pulley. For varying the speed of this worm-shaft, a sliding forked guide is provided and is controlled by a hand-wheel on the rear end of the floating support.

The travel of the belt depends upon the material treated. If a rich coarse pulp is fed onto the machine, the speed will be slower than if concentrating a lean coarse pulp; and the same thing will be true when handling slime. The incline of the belt also depends upon the character of material treated and will vary from two to six inches in its complete length. When concentrating a fine pulp, containing a large proportion of gangue and only a small portion of mineral, the grade of belt will be small, say about two to three inches, whereas, if the material is coarse and heavy, the grade will be increased. With the adjustment of this machine, the grade of the belt can be regulated quickly and accurately.

Owing to the great variety of ores treated on a machine of this kind, it must be so constructed as to permit of a wide range of adjustment. Adjustable eccentrics for varying the side shaking motion are provided, by which a long or a short stroke can be obtained.



BOOKS RECEIVED.

'Mining, Mineral, and Geological Law.' A treatise on the Law of the United States. By Charles H. Shamel. Published by the Hill Publishing Co. 620 pages. Price $5. For sale by the Mining and Scientific Press. This business-like volume, of standard 6 by 9 in. size, bound in durable buckram, with a leather label, creates a good impression at first sight, and the impression is fully confirmed by a glance at the well illustrated pages. It is a most useful book, prepared by a scholar who is both a lawyer and a scientific man, and written with a generous spirit to other workers in the same field. The contents include an outline of the mining law; the definitions of geology; a sketch of the law of property in minerals; legal definitions of mineral and ore, with citations from celebrated cases; theories of ore formation, with the necessary drawings and references; the extra-lateral right and the interpretation of it; mining laws as applied to the public domain; acquisition of mining rights; scientific definitions of veins; the legal definition and litigation; tunnel and placer rights; and finally an appendix giving the United States mining laws and the Land Office rules and regulations in reference thereto, ending with a bibliography and other useful information. The foregoing will give the reader an idea of the

comprehensive and practical character of the book. It is rarely given to any writer to cover two or three branches of learning without blundering, and as a rule the attempt to be lawyer and geologist concurrently evokes vigorous criticisms from both professions, but in this case we discern no cause for finding fault; we thank the author for honest work well done, resulting in a book as useful as it is interesting, and likely to be of the greatest value to those engaged in mining.

'Engine-Room Chemistry.' By Augustus H. Gill, Associate Professor of Technical Analysis, Massachusetts Institute of Technology. Hill Publishing Co. 198 pages. Price $1. For sale by the MINING AND SCIENTIFIC PRESS. This is a compendium on the subject written for the engineer and engineman so as to enable him to understand the scientific principles underlying the modern instruments used in power plants and to comprehend the principles of combustion and lubrication. The author assumes no greater knowledge of chemistry and physics than can be obtained from elementary books such as the 'Science Primers,' published by the American Book Company.

VACUUM PUMPS FOR DIRTY WATER.

The idea of raising water by the condensation of steam in a chamber and then forcing it up to a still higher level by the direct pressure of steam on the surface of this water in the same chamber, originated with Capt. Thos. Savery, who in 1698 patented his celebrated 'fire engine.' Properly speaking, his device was not an engine but a sort of pump, a forerunner of the present Emerson steam-pump. In operating Thos. Savery's engine one cylinder was filled with steam, the steam valve was closed by the operator and a spray of water was then injected into the steam. The continual services of a man were needed to operate the steam valve and an almost continuous stream of water was delivered. A great sale was built up for this pump until Newcomen's atmospheric engine displaced it and piston pumps began to come into the field. The displacing of Savery's pump was largely due to the fact that the expansive power of the steam was wasted, and the steam consumption was hence enormous. No progress was made in vacuum steam pumps for nearly 200 years, when in 1872 and 1881 Charles Hall patented the pulsometer.

A saving of at least 25% in the amount of fuel, one of the main advantages of the Emerson pump, is the result of early steam cut-off, which is made possible by the design of the rotary slide valve steam ports.

In general, as shown in the sectional cut, the Emerson pump consists of two long cigar-shaped cylinders or receiving tanks, each connected at the bottom through upward opening valves with the suction pipe; and also connected, again with upward opening valves, with the discharge pipe, thus having but four valves in all for the average standard pump.

In the Emerson pump the steam is used twice. First it presses directly down on the surface of the water in the chamber and forces it out through the discharge pipe. Second, this same steam is itself then suddenly condensed, creating a vacuum which refills that chamber with a new charge of water. Where two cylinders are used as shown in the picture one of them (which we will call cylinder No. 1) with full boiler pressure acting on the top of the water, is discharging; while at the same time the other cylinder (which we will call No. 2) has just created an almost perfect vacuum and is sucking in the water. Filling the vacuum requires less than two seconds, and after an interval of only a fraction of a second the next inrush of steam into that chamber empties it in about two more seconds. After an interval of but a small fraction of a second, the water having been expelled and cylinder No. 1 full of live steam, a jet of cold water, as shown in the picture, is forced from cylinder No. 2 into this steam, condensing it and creating an almost perfect vacuum, thus completing the cycle for cylinder No. 1. This cycle can be summarized as follows:

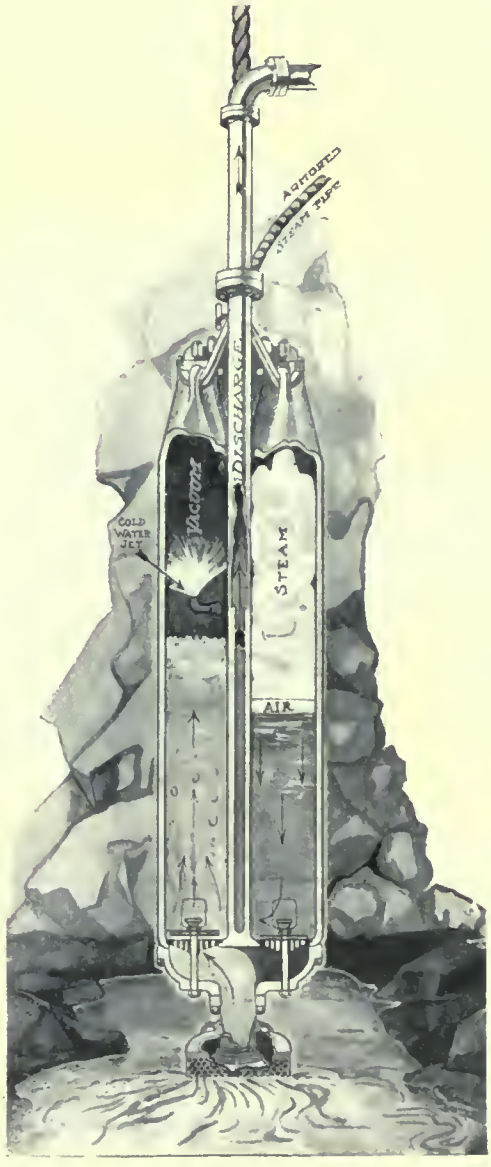
A. Steam admitted to cylinder No. 1 forces out liquid.

B. Same steam condensed by jet of cold water from cylinder No. 2 creates vacuum.

C. Vacuum thus formed refills No. 1 with water from the suction pipe, regardless of possible inrushing air, until the vacuum is relieved.

These items take place alternately in the two chambers. That is, comparing this pump with the human heart, one cylinder is acting as an auricle while the other is acting as a ventricle.

As all users of pumps realize, the wear and tear created by sand, grit, loam, or any foreign matter, is a very serious item. By studying the pictures herewith it will be noticed that the liquid being pumped never comes in contact with anything which moves, except the four round rubber valves, two in the suction and two in the discharge pipes. Thus



the gritty material can be handled without the necessity of frequent repairs because the Emerson pump employs no plungers, pistons, piston rods, glands, stuffing boxes, nor any other moving parts to come in contact with the water being pumped.

The weight per given capacity is considerably lower than that of any other pump on the market. A pump with a capacity of 1200 g.p.m. against a 25-ft. head weighs only 2700 lb. It should be remembered, too, that there is no engine to be bought in order to furnish power to the Emerson pump, since the steam from the boiler is made to act direct, both in expelling the water and, by means of a vacuum, in sucking in the supply from the sump. Since this pump is self-contained and operates entirely on the principle of steam expansion against a column of liquid, it follows that its weight is less than the weight of other pumps plus the weight of the engine necessary to drive them.

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Editorial.

GENERAL FINANCIAL conditions are improving rapidly. Manufacturing establishments are re-opening, the metal markets are more cheerful, and freight traffic is increasing. The violence of liquidation has spent its force and the normal progress of industry is being resumed. As soon as the result of the presidential election can be discounted, a complete recovery will be hastened.

FROM NEW YORK we learn that there is a marked revival of financial interest in mining, notably in the enterprises under way at Guanajuato. This is due to recent discoveries of rich ore in the San Nicolas El Monte, the Penguico, and the San Cayetano mines. We hope these finds will prove important, for the men that have devoted their energies and their skill to the development of the old mines of Guanajuato deserve success. *Buena suerte mis amigos.*

LAST YEAR Mr. W. A. Caldecott, consulting metallurgist to the Consolidated Gold Fields of South Africa, came to this country and to Mexico with a view to seeing new methods of cyanidation. On his return he told his technical friends at Johannesburg what he had seen. The observations of so fair and experienced a critic are of interest to cyaniders everywhere, so we have abstracted the larger part of the paper that Mr. Caldecott read before the Chemical, Metallurgical & Mining Society of South Africa.

THE *Morning Howl* and the *Evening Scream*, the leading papers of San Francisco, continue to publish big advertisements of the Industrial Investment Co., in which that Arizona corporation offers stock in prospects at Rawhide, Nevada, to the people of California. "You can buy stock at 5 cents per share today and tomorrow," but "on Sunday next the price will go to 10 cents." Hurry up. Among the powerful arguments for making such a purchase is the fact that the *Daily Mining Record*, of Denver, "the recognized mining authority," speaks handsomely concerning the Investment Co.'s holdings. The president of the latter is advertised as "former western manager of the *Daily Mining Record*," hence the interchange of compliments between the advertisements of the one and the columns of the other. As a matter of information it may be added that the Denver paper mentioned is not in the least authoritative on any subject, and is chiefly remarkable as an incubator of wild-cats.

INFORMATION not intended for publication is usually more interesting than that which is prepared for publicity. On another page we reproduce

a letter written by one mine-operator to another in regard to Rawhide, Nevada. This general account of impressions gathered during a visit to the new mining camp is published by permission of both writer and recipient, but their names are omitted, for obvious reasons. To us the letter is interesting not only as indicating the unwillingness to form a final opinion but also the earnest effort to interpret the occurrence of ore in the light of current geological knowledge. It illustrates the tremendous advance made by the science of geology in winning the respect of hard-headed men and their belief that it aids them in understanding the conditions that make mines. Note also how disinclined the operator —an experienced man—is to condemn the district, although he sees that it is being over-boomed and is obviously being used as an excuse for all sorts of nefarious schemes. The record of Cripple Creek, Kalgoorlie, Goldfield, and other gold-mining districts that have won fame during the last twenty years has been a warning against hasty opinions. Even spurious promotion cannot kill a rich district, although it may hinder its development.

Mining and Metallurgical Societies.—III.

IN the two preceding articles we have discussed the character, function, and performance of the existing organizations comparable to the Mining and Metallurgical Association, which it is the intention of some of our friends to form forthwith. Having refreshed our memories in regard to the work done by the Institute, the Institution, and the Mining Congress, we are in a better position to discuss the prospects of the new Association. And what may be the purpose of it? This is answered by making excerpts from the circular letters received by many of our readers. It is stated that:

1. The Association is intended to be one in which membership will have some meaning as to professional standing. To accomplish this, membership is to be restricted to those credited with technical attainments and honorable achievements.

2. It is not the intention to build up a society that shall be a rival of either the Institute or the Mining Congress. The diffusion of technical knowledge is the principal object of the Institute, and the improvement of mining conditions is the end sought by the Mining Congress; the objects of the first are educational and technical; of the second, economic and legislative. The purpose of the Association is technical and ethical.

3. As it is not desired to weaken the Institute by lessening its membership or diminishing the interest in its continued prosperity, it has been suggested that membership in the Institute be a condition precedent to becoming a member of the Association.

Referring to the first paragraph, it has been proved by the experience of the other societies that absence of restriction results in a nondescript membership, impotent in public or professional matters, because deficient in solidarity; while, on the contrary, a restriction, if based on training and performance, will produce such fellowship as is stimulating to good work, that is, work in the direction for which the society is organized. One of the most effective precautions is to require a large number of sponsors, all of whom have personal knowledge of the candidate. Members should have it impressed upon them that they are on their honor not to sign applications irresponsibly.

The second paragraph states the case plainly, but, on the very face of it, there is need of a correction. The repetition of 'technical' in summarizing the objects of the three organizations, suggests that there is a chance of duplication of work and therefore of rivalry between the Institute and the Association. It is true that the Association will be composed of technical men especially qualified to discuss technical subjects, and therefore it seems natural that technical papers should be read at the meetings of its members, but if this is done, then the declaration as to unwillingness to injure the Institute, as expressed in paragraph No. 3, is without sincerity, for it is obvious that the Association will attract the reading of many of the best papers, which otherwise would be sent to the Institute for publication. As we have the most thorough belief in the sincerity of purpose prompting the organizers of this new Association, we urge them to excise the word 'technical' from their program. Any attempt to include the reading (and consequent publication) of technical papers will be a trespass on the good work now being performed by the Institute under Dr. Raymond; it will lead to rivalry, bitterness, and all sorts of misunderstandings. And it is not necessary for the Association to perform this function; it is being well done already. Besides, there is other territory not already pre-empted. It is the ethical, social, and professional sides of the mining engineer's, metallurgist's, and geologist's life that need buttressing and stimulating; it is the relation of the engineer not to nature but to his fellow man that requires elucidation and elevation. There is plenty of scope. The Association should not hesitate to invade the ground traversed by the American Mining Congress, for neither on the score of representation nor performance has the Congress won any prescriptive rights. Similarly, most of the State organizations, such as our California Miners Association, have failed to be representative and have been unable to develop any such public spirit as would have given them the motive power to be serviceable in a large way to the community. Therefore the new Association is warranted in concerning itself with such industrial and legislative problems as interest a mining engineer imbued with civic spirit. The reform of the mining law, fraud in mining, the engineer's relation thereto, smelter rates, national administration of mining affairs, the work of the Geological Survey, the labor problem—these are a few of the topics that will be perennially interesting and upon which the Association can give an authoritative opinion. In short, let the Association undertake to do what the Congress never could do; let it avoid doing what the Institute does so well; let it tackle the problems that the Institute has chosen to disregard. Above everything, the Association should

devote itself to improving the relations between professional men engaged in mining and metallurgy, and the relations of those men to the public. Surely that in itself is enough to constitute a bond of fellowship. There will be discussions, and those discussions can be printed, as are the proceedings of other societies, and in the end we shall have a body of literature quite as interesting and as useful as the description of a gold mine or the details of a cyanide plant. There is no reason to fear a lack of subjects, for when national and industrial problems relating to mining have been satisfactorily settled—in the Greek kalends—there remain ethical and professional questions of great interest and subtlety, and as numerous as the many-sided human nature of which we are all composed. We may suggest: 'Standardization of professional practice,' 'A rudimentary code,' 'Our relations to the public,' 'Amenities between the consulting engineer and the manager,' 'Duty of the engineer to his directors,' 'Should engineers speculate,' 'Is it advisable to own shares in the mine you are managing.' 'Is it right to resign when the ore becomes refractory,' 'When does loyalty end, and self-interest begin,' 'Why directors are incapable,' 'Why shareholders are a nuisance,' and so forth. Gentlemen, you have a new world to conquer, let the Institute and the Institution, and even the Mining Congress, elucidate the operation of machinery and the working of mines, you have the varied, variegated, and vast domain of human conduct in its relation to the mining industry. Is not that enough?

Next, as to details: Would it not be well to have an understanding or unwritten law among members that membership be not used as a diploma of efficiency, nor appear on letter-heads, nor be used as a luminous tail to a signature—in short, that inclusion within the Association be treated as we treat membership in a club. Has not this infraction of good taste brought scandal upon many scientific societies and technical institutes? Is it not an abuse of fellowship? Further, even if the endorsements required of a candidate to membership be limited to the usual number of three, would it not be advisable to insist not only upon personal acquaintance but also some definite knowledge concerning the antecedents of the candidate. If a right start is made in this regard, it will be easy to establish a precedent, but if undue anxiety is shown for the enrollment of a large number of members, then there will be an inevitable laxity, ending in giving the Association a heterogeneous composition fatal to its effectiveness. Other societies furnish plenty of warnings. Mere numbers do not mean much. An organization shows stronger vitality and can do better work if out of 500 members, 100 or 125 foregather, than one having 4000 members, of whom only 50 to 100 come together. The social side of this Association ought to be a distinct feature of it. Man is a sociable animal rather than a gregarious beast, and there is no doubt that engineers, especially the nomads engaged in mining, love to compare notes and exchange experiences in an informal fashion, not necessarily at costly banquets, but in a simpler way, when conversation supersedes speeches, and plain food accompanies well-seasoned talk. If meetings are held at various centres, according to the distribution of membership, even if only a handful assemble, the occasion can be made useful in furthering the objects of the Association. The desire to be present will be strengthened by the expectation of contact with men of kindred spirit, fellows full of interesting information, and members glad to emphasize the essentials of intelligent fellowship. The important meetings are likely to be held in one or other of the cities on the Atlantic seaboard, but it might be arranged that on the same day those unable to attend would foregather in their own habitat or, better still, agree to do so on the arrival of the report of the Association's general meeting, with a view to discussing the subjects brought forward on that occasion. In this way the discussion of professional matters could be made general, and every member would have a chance to exchange ideas with some of his fellow members. The post and the telegraph, not to mention the wireless sympathy of men engaged in kindred pursuits, render it easy to maintain inter-communication, always provided that the membership is so selected as to constitute a fraternity. There exists the material for such an Association and there is the will to give it motive power, for already over a hundred men have agreed to become charter members. Among them is the present writer, for not otherwise would it have been permissible for him to be so frank in his criticism and recommendations. We hope the Association will become a power for good in improving the relations between professional men, and between them and the public. If it does that, it will have performed a great service to mining and metallurgy.

Postal Regulations.

BY ORDER OF the Post-Office Department, it has been ruled that expired subscriptions are no subscriptions at all, and unless renewed within a certain specified period the copies mailed on account thereof shall not be accepted at the second-class postage rate of one cent per pound, but may be mailed at the transient second-class rate of one cent for each four ounces or a fraction thereof, prepaid by stamps. It is needless to say that publishers cannot afford to pay the transient rate; in the case of the MINING AND SCIENTIFIC PRESS the postage would be $1.04 per annum. This ruling has been generally endorsed by reputable papers, for it infringes no rights and is calculated to stop abuses that have prostituted journalistic enterprise to the use of the worst forms of feline finance. Too many publications masquerading as technical or financial journals are merely circulars for the advertisement of swindles, they are mediums of misinformation of the rankest kind, and are not entitled to the postal facilities meant to further legitimate enterprise. It is a fact that newspapers and periodicals enjoying the second-class mailing privilege constitute 67 per cent of the matter carried in the mails, but yield only 4 per cent of the total revenue. No wonder the Post-Office authorities have called a halt. They will be supported by all reputable publishers.

Personal.

M. L. Requa is at Ely.

Horace V. Winchell is at Goldfield.

Thos. H. Leggett is at Globe, Arizona.

Waldemar Lindgren is in San Francisco.

Edgar Rickard has returned from New York.

Gelasio Caetani is at New York, on his way to Rome.

W. Murdoch Wiley is at the Engineers' Club, New York.

A. Chester Beatty is expected in San Francisco next week.

H. J. Baron has resigned as associate editor of *Mining Science.*

Wilbur E. Sanders has moved from Los Angeles to Nevada City.

Wilton E. Darrow, of Sutter Creek, is in San Francisco for a few days.

Fred A. Gowing has returned from Rawhide and Golden Circle, Nevada.

John C. Montgomery was here. He is now at Rawhide, accompanied by Henry Krumb.

H. P. Gordon is now foreman of the San Domingo hydraulic mine, near Angels, California.

C. H. Munro has returned from Colombia, where he has been prospecting dredging ground.

E. W. King, of Bozeman, Montana, is heavily interested in the new prospects at Rawhide, Nevada.

C. B. Lakenan is general manager for the Steptoe Valley Smelting & Mining Co., at Ely, Nevada.

W. E. Thorne, of Auburn, has been doing professional work in Tehama and Shasta counties, California.

Foster Hewett, of the Pittsburgh Testing Laboratory, is in San Francisco, on his way from Grass Valley to Pittsburg.

J. H. Hartley and his brother, Z. B. Hartley, have formed a partnership as mining engineers, at San José, Costa Rica.

Edgar A. Collins, superintendent for the Montana-Tonopah Co., goes to England in April, to be absent on a three months' holiday.

W. A. Connelly, superintendent of the Constancia mines, in Nicaragua, sailed from New Orleans on March 14, on his return to Nicaragua.

Frank M. Estes, Jr., formerly mine foreman of the Esperanza, has returned from a trip to Europe and is now in the Joplin district of Missouri.

F. B. Weeks, who has been connected with the U. S. Geological Survey for the past 18 years, has recently resigned. His address for two or three months, while completing certain reports for the Survey, will be 1201 Euclid St., Washington, D. C.

Rensselaer H. Toll, who has been engaged for the past ten years in gold-mining and milling operations in the Southwest and Mexico, during which time he has had charge of several important enterprises in the La Plata and Cripple Creek districts, has opened an office as consulting engineer at 522 Mining Exchange, Denver.

Cortlandt E. Palmer, connected with the Guggenheims for the past five years in charge of mine and mill construction and operating in the United States and Mexico, has modified his arrangements with these interests. Mr. Palmer will act in future in an advisory capacity to the American Smelters Securities Co., without field-work, and will continue in charge of operations for the Esperanza Mining Co. as vice-president and consulting engineer. Additional to the above, Mr. Palmer has accepted the appointment of general manager for the Guanajuato Development Co., operating the Peregrina and Pinguico mines and mills and a number of allied enterprises at Guanajuato, Mexico, his headquarters being at 40 Wall St., New York.

Latest Market Reports.

LOCAL METAL PRICES—Mar. 26.

Antimony	12@16c	Quicksilver (flask)	$45@45.50
Casting Copper	14¼@15¼c	Spelter	6½@ 7¼c
Pig Lead	4.35@ 5.30c	Tin	31½@33c

ANGLO-AMERICAN SHARES.

Cabled from London.

	Mar. 19. £. s. d.	Mar. 26. £. s. d.
Camp Bird	0 13 3	0 13 1½
El Oro	1 1 3	1 2 6
Esperanza	1 3 9	1 4 4½
Dolores	1 5 0	1 5 0
Oroville Dredging	0 11 6	0 11 6
Stratton's Independence	0 3	0 3 3
Tomboy	1 8 9	1 8 9

(By courtesy of W. P. Bonbright & Co., 24 Broad St., New York.)

MINING STOCK QUOTATIONS—NEW YORK.

	Closing prices. Mar. 19.	Mar. 26.
Bingham Central	⅜	½
Boston Copper	14⅜	15
Cumberland Ely	8⅝	7½
El Rayo	1⅜	1⅜
Giroux Con.	3¼	3⅞
Guanajuato Con	2	.....
Nevada Con	11½	13⅜
Nipissing	6¾	7
Tennessee Copper	32	38¼
United Copper	4⅜	4¾
Utah Copper	28¼	33½

(By courtesy of Hayden, Stone & Co., 25 Broad St., New York.)

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date	Electrolytic Copper	Lead	Spelter	Silver
Mar. 20	12.81	3.95	4.67	55⅝
" 21	12.81	3.95	4.67	55¼
" 22	Sunday.	No market.		
" 23	12.81	3.95	4.67	55⅝
" 24	12.87	3.95	4.67	55¼
" 25	13.12	3.95	4.67	55¼
" 26	13.12	3.95	4.67	55¼

SOUTHERN NEVADA STOCKS.

San Francisco, Mar. 26.

Atlanta	$ 24	Manhattan Con	16
Belmont	1.10	Midway	54
Columbia Mtn	21	Mizpah Extension	05
Combination Fraction	68	Mohawk	.....
Daisy	1.30	Montana Tonopah	1.60
Fairview Eagle	50	Nevada Hills	2.85
Florence	4.15	Rawhide Queen	1.82
Gold Bar (Bullfrog)	20	Red Top	.....
Goldfield Con	5.15	Sandstorm	35
Gold Kewanas	38	Silver Pick	25
Great Bend	42	St. Ives	26
Jim Butler	28	Tonopah Extension	88
Jumbo	.....	Tonopah of Nevada	6.20
Jumbo Extension	33	Tramp Con	19
Laguna	95	West End	26

(By courtesy of W. C. Ralston, 353 Bush St.)

COPPER SHARES—BOSTON.

	Closing prices. Mar. 26.		Closing prices. Mar. 26.
Adventure	1¾	Michigan	11
Ahmeek	56	Mohawk	50
Allouez	26	Nevada Con	13
Amalgamated	60	North Butte	55⅛
Arcadian	3¾	Old Dominion	37⅛
Atlantic	10	Osceola	83
Bingham Con	87	Parrot	.....
Boston Con	14⅜	Phœnix	50
Butte Coalition	22	Quincy	84
Calumet & Arizona	104	Rhode Island	3
Calumet & Hecla	635	Santa Fe	1⅞
Centennial	22	Shannon	12⅛
Con. Mercur	.....	Superior & Pittsburg	13
Copper Range	65	Tamarack	64
Daly-West	8¼	Trinity	15½
Franklin	7½	United Copper com	4⅞
Granby	90	Utah Copper	.....
Greene-Cananea, ctf	.....	Victoria	3
Isle Royale	.....	Winona	5½
Mass	2½	Wolverine	125

General Mining News.

ARIZONA.

COCHISE COUNTY.

(Special Correspondence).—A meeting of the directors of the Calumet & Arizona Mining Co. was held recently at the Copper Queen hotel in Bisbee. It was decided to allow the option on the Leadville group near Gleeson, Ariz., to expire. This is one of four properties that the Calumet & Arizona has held by option and upon which the company has been doing development work for the past eight months. A final payment of approximately $300,000 was due on the day of the meeting. No action was taken on the dividend.

Bisbee, March 20.

CALIFORNIA.

BUTTE COUNTY.

At the Big Butte drift placer mine the pay gravel has been reached in a raise. The mine is on the west side of Big Butte creek, 18 miles from Chico.——The new power plant of the P. B. Steifer Mining Co., being erected near Magalia, is nearly finished and will start up about the beginning of April. The plant will develop 360 hp., which will be used for pumping and hoisting.

CALAVERAS COUNTY.

Rich placer ground has been found, covered by a slide in Buckeye gulch by McSorley. The gold is exceptionally coarse. The extent of the deposit is not yet known.

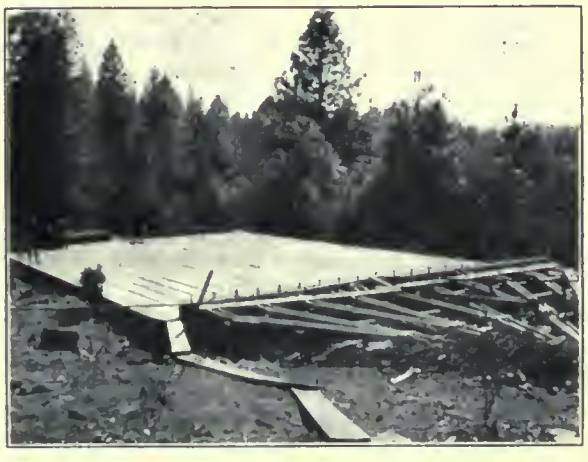
NEVADA COUNTY.

(Special Correspondence).—A movement of considerable importance to the mining industry is taking place in this district. It is a plan providing for running a long tunnel to drain the mines of Nevada City and Grass Valley. An attempt was made a number of years ago to run the tunnel, but it proved abortive on account of poor management and lack of funds. This tunnel is to be started on the South Yuba river, at an elevation of 1150 ft. above sea level (somewhat lower than the first one), and running on the quartz lodes which follow the contact between the granodiorite massif and the porphyrites and metamorphic schists, it will reach the Champion mines in a distance of 15,000 ft. After traversing the Champion veins for a distance of two miles, it will leave the contact and, turning southward, will cut in turn the rich and productive veins of Grass Valley.——From the district tributary to this adit a steady production has been maintained for almost 60 years. At present at least $250,000 per year is spent on pumping. A small percentage of this amount, it is stated, would pay the interest on the cost of the adit, and the remainder could be used in the further development of the mines. Considering the relatively flat dip of these veins, it is apparent that an adit which drains them at a vertical depth of from 1100 to 1800 ft. will be of great value in their further development. This adit will strike the Champion shaft at the 2200 level, the Empire about the 2500, and the North Star at the 3400 level. These mines and the Idaho-Maryland are the only ones that are at present as deep as the projected drainage tunnel, and there are over 30 shafts of considerable depth along that line.

It is estimated that the cost of the entire tunnel will be about $1,000,000, but it ought to be paying its own way long before it is completed. The leading mining and engineering people of the district are not doubtful as to the feasibility of the scheme and the advantages that are bound to accrue from it. Besides the drainage work, the tunnel company will have a large field in the way of handling ore, which will be done with electric haulage. Water and electric power are both easily available at the portal.

Nevada City, March 23.

A discovery of rich ore has been made in the winze in the 300-ft. level north of the Kenosha shaft. The streak is 8 to 10 in. wide and carries free gold. The ore is a white quartz, with sulphides and free gold. A cross-cut will now be run on the 400-ft. level to cut this vein. The mine is situated on Deadman's Flat.——Work in the Belle Union mine has been delayed by caving ground. It is expected that the vein will be cut within a few days.——Rich gravel has been struck in the Posey Canyon gravel mine. An adit has been driven during the last three years, and a 16-ft. raise encountered the old channel. Drifts and cross-cuts will now be driven to determine the extent of the pay gravel. H. C. Zapf is president of the company.——The Jenny Lind company is driving an adit to reach the same channel.——At the Bessie mine preparations are being made to erect a stamp-mill. The development work has been carried to a depth of 200 ft. and good hoisting and pumping machinery is installed. The mine is situated in Brown's valley.——A hoist is being erected at the Champion mine to sink a winze from the 800-ft. level. This will be sunk 300 ft. and connected with the Wyoming shaft.——Considerable interest is centred on a discovery made about 13 miles below Nevada City, where a large lode, containing some silver and lead and traces of gold, has been uncovered and traced for a great distance. A. D. Foote, superintendent of the North Star mines, is said to have bonded 360 acres of the best land.——The company which recently secured a bond on the Republic mine near Graniteville, has started work there. This week several men were put to work to extend the lower adit. The work of development will be carried on steadily, and through this adit a large amount of new ground can be opened up. As soon as the snow disappears and the roads are open the machinery for the additional five stamps will be hauled to the Republic and installed. The company intends to do much work there this year, and thoroughly open up the property.



Slime Plant, Empire Mine, Grass Valley.

(Special Correspondence).—A rich shoot of ore has been encountered at a depth of 300 ft. in a winze at the Kenosha. The quartz carries free gold, and was found north of the shaft. Several good specimens were extracted. The shaft is going down rapidly. A drift has been started from the 400 level to cut the vein.——It is announced that work on an enlarged scale will shortly start at the West Point mine. A small crew of men are at present engaged sinking a prospect shaft on a vein on the west side of the mine.——A good lode of milling ore is being developed at the Gold Mound. Sinking continues steadily, a small force of men carrying on the work. Howard P. Dennis is superintendent.——The shaft at the Normandie mine is going down. Several promising shoots of ore have been encountered.——A good shoot of ore has been struck in the Sultana group. Extensive development work is going on.——Small quantities of rich ore have been encountered in a winze at the Pennsylvania mine. It is expected that the main pay-shoot will soon be tapped.——Active operations have commenced on property adjoining the Mason ranch, recently bonded by A. D. Foote and associates. A 25-ft. prospect shaft is being sunk and a cross-cut will be driven from the bottom of the shaft. A. Hall has been placed in charge of the work. If the ore proves sufficiently rich, shipments will be made through New England mills to reduction plants.——The Native Son mine in the Blue Tent district has been bonded to J. H. Bishop. Several

men are at work clearing out the old tunnels, preparatory to the driving of a cross-cut to intersect several small veins exposed near the surface.——Two adits, 180 and 80 ft. long, respectively, and a 150-ft. cross-cut tunnel have opened up a large body of ore at the Golden State group near Chicago Park. Several winzes disclose fair-grade ore. A small force of men are driving the cross-cut to intersect the orebody.——It is rumored that Colorado people are negotiating for the purchase of the Mountain Maid mine. ——Several men have been added to the working force at the Republic mine, and the lower tunnel is being rapidly pushed. The company is arranging for carrying on extensive development activities.——Arrangements are being completed at the Champion mine to sink a winze from the 800 level to a depth of 300 ft. Connection will be eventually made with the Wyoming shaft. George Mainhart is superintendent. A hoist has been installed to facilitate the work.

Grass Valley, March 23.

PLUMAS COUNTY.

H. H. Yard, who has operated extensively in Government lands in Butte and Plumas counties, seeking to obtain public domain, has lost possession of about 265,000 acres along the Feather river. The Land Office at Susanville has rendered a decision and report setting forth that in more than ninety claims there is no evidence of mineral. The lands taken by Yard, largely, as the Land Office claims, through dummy locators, under the plea that they are mineral in character, cannot be held by him, and revert to the Government as timber lands. The assessment work which he claimed had been done, partly by prospectors, before the advent of Yard, consists of roads and telephone lines, which do not constitute lawful assessment work. The decision further states that the prospects made by Yard, as well as those made by the Government, prove that there is no placer gold in the claims which would justify the claim that they are of mineral character.

COLORADO.

CLEAR CREEK COUNTY.

(Special Correspondence).—The holdings of the Red Oak M. & M. Co., situated on Democrat Mtn., have been sold to C. H. Porier, representing a syndicate of St. Louis (Mo.) capitalists. It is reported that a cash bonus of $25,000 was paid, and that the balance of $125,000 will run one year. Work has already been started, and a raise is to be carried from the Scepter adit to connect with the Sunburst adit. This raise will be 370 ft. high, and when completed will permit of the extraction of the ore found in the Sunburst workings at a greatly reduced cost. An aerial tramway will be run from the portal of the Scepter adit, the terminus to be at the site of the Red Oak mill which was destroyed by fire a few years ago.——The Riley lease on the Grant level of the Sunburst continues to improve, and from a shipment of a car-load of second-class ore returns of 225 oz. silver per ton and 12% lead resulted. A new streak has just been uncovered in the stope, which is up 30 ft., and a heavier tonnage is now being mined.——Within 30 days the raise being carried on the Seven-Thirty vein to cut the old workings, and at the same time draining them, will have been completed. This undertaking will result in opening a block of virgin ground that is 1½ miles in length by 150 ft. in height. Owen Rice is general manager.——The adit being run on the Shively to intercept the 500-ft. level of the shaft workings is nearing the objective, and B. J. Martelon, the manager, states that within the next 40 days the objective will be reached. At that time several miles of old workings will be drained, permitting the extraction of the large bodies of low and medium grade ore which are known to exist.——The machinery of the Mendota mill was started up this week, after a temporary close-down of four months. In the meantime a number of improvements were made about the premises. This plant is being fed upon dump matter and ores left in the old stopes above the Victoria adit, and it is estimated that there is enough ore available to run 10 years.——Development will be actively prosecuted on the Dorlc adit holdings, situated on Saxon Mtn. This property has been secured by the Magnet M. & T. Co., operating under a lease. A large tonnage of ore is being broken and shipments have been started to the local sampler. The ore is worth $100 per ton in gold, silver, lead, and copper. C. E. Carpenter is directing the work.——The Raymond adit on Griffith Mtn. is being rapidly advanced. Since cutting the Paris vein, driving has been in progress, a streak of heavy lead ore 8 to 12 in. wide being followed, assaying $16 per ton.——Butts & Co., leasing on the Aastor, have broken into a new streak of high-grade ore. In carrying the raise a body of smelting ore has been encountered that measures from 8 to 10 in. wide.——The discovery made on the Sporting Times mine a few weeks ago is proving up to expectations. The streak has gained in size from 6 to 10 in. The first mill-run produced $84.70 per ton. This property is owned and operated by A. H. Colburn.——A night shift has been put on at the Capital mill.——Hall & Co., leasing on the sixth level of the Bellevue-Hudson, are breaking a steady tonnage of high-grade ore. Stoping is in progress upon a body of ore from 1 to 5 ft. wide. The stuff is being milled in two classes, and assays 174 and 45 oz. silver per ton. The discovery was made in cross-cutting to catch the hanging wall, which was never explored by the old workings.——At the electric plant of the Two American Sisters M. M. P. & E. Co., a 500-hp. steam engine is to be installed, which is to be used as an auxiliary plant. In addition to this, wires are to be run into Georgetown for the furnishing of light and power. At the mine the working force has been increased. J. J. White serves as general manager to this company.——F. A. Maxwell, lessee of the Colorado Central, is maintaining regular shipments of high-grade silver ore from the sixth level. The streak measures from 18 in. to 2 ft. wide, the ground having been opened for 75 ft. One wagon-load of this ore shipped last week brought $1824 net.——The Tol Reynolds on Alpine Mtn. is again undergoing development. A wagon-road recently constructed will result in the product being marketed at a greatly reduced cost.

Georgetown, March 21.

SAN JUAN COUNTY.

Nearly 5300 tons of ore have been shipped from the Silverton district during February. The shipments of concentrates aggregated 5225 tons. The Gold King shipped 2300, Silver Lake 1925, Iowa 725, Sunnyside 175, Old Hundred 100 tons. Fifty tons of crude ore were also shipped. ——The Champion adit will be driven the next 300 ft. by a contract which will be let shortly. The adit is already 700 ft. long, and it should cut the Champion vein at 1700 ft. from the portal and 1100 ft. below the outcrop. Work will soon be resumed by the Green Mountain M. & M. Co. Considerable ore is blocked out, and a satisfactory output for the summer season is expected.

TELLER COUNTY.

The Maud S. Leasing Co., operating on the Red Bird of the National Mining Co.'s ground on the west slope of Gold hill, are driving on a strong vein on the third level, about 150 ft. northwest of the shaft. The vein lies in the phonolite and shows good ore. The vein is increasing in strength as work progresses, and the company hopes to open up a big body of shipping grade ore. A 30-ton shipment was made recently by Powers & Anderson, sub-leasing on block 191 of the Stratton, and the returns showed $32 per ton. The ore was taken out above the 50-ft. level, where a good vein has been exposed. This block has recently been sub-let by Dr. Driscoll and associates, and two cross-cuts are being driven by the new operators.——The contract for sinking the shaft on the Friday claim on Tenderfoot hill a distance of 50 ft. has been completed, and Philip Schuch, the manager, will prosecute the work hereafter on company account. The shaft is down now 125 ft., but it is the intention of the company to sink another 50 ft., when considerable lateral work will be done. No ore is being broken at the present time. The Abe Lincoln mine in Poverty gulch is developing better than it has been at any time since the fire that destroyed the shaft-house on the night of Jan. 1. Five machines are at work

breaking ore of good grade from the fourth, fifth, sixth, and seventh, and two machines are engaged in driving cross-cuts southwest on the 700-ft. level. A good vein of ore showing sylvanite has been encountered in a winze sunk from the 7th level to a depth of 100 ft., but at that point water has handicapped operations. A new spray washer with a capacity of 100 tons daily has recently been installed, and all of the coarse rock is being run through. The slimes, which have heretofore been wasted, have added considerably to the gold output of the property. An elevating tram has also been completed, which lifts the waste from the washer to a point about 40 ft. above the old dump level, which obviates the difficulty before experienced in obtaining dump-room. All of the four sets of lessees on the property are reported as being in ore of good grade, and the mine is producing a car of smelting grade ore a day.

Two important discoveries have been made in the deeper workings of the Lee shaft in the past few days. At the 800-ft. level the No. 4 vein has been entered by cross-cut and from 6 to 8 ft. of ore exposed, returning 4 to 6 oz. gold per ton. This vein was first cut at the 1100-ft. level and in succession in the 10th and 9th levels. A cross-cut will be carried from each succeeding level, and from present indications it will extend upward to the surface, as little work has been prosecuted in this direction in the upper levels. The second and more important find was made at the 900-ft. level. At this depth a vein new to the property and lying parallel to the No. 4 has been encountered. The new vein is fully 4 ft. wide, and at a conservative estimate will ship at 2 oz. gold per ton.——The production from the properties of the Work Mining & Milling Co. situated on Raven and Gold hills, during the month of February amounted to 354 tons, of a gross value of $18,460. The net returns, after the deduction of freight, haulage, and treatment charges, was $15,322, and the royalty paid the Work company's treasurer $5587.——Nine cars of ore shipped before the close of the month and on the way to the valley mills or smelters, are not included in the above. The average value of the ore marketed was $52.48 per ton.

IDAHO.

IDAHO COUNTY.

An important find of high-grade galena is reported on the Amy group of claims in the Pine Creek district.—— The contract to drive a 2800-ft. adit on the Reindeer property has been begun. The contract price is $10 per foot.—— The adit being driven by the Victor Mining Co. on its property in Shields gulch in the Evolution mining district is in 450 ft., and a vein 2 ft. wide has been found.——The North American M. & M. Co. has commenced suit against the Big Creek Mining Co. to clear title to its mining claims in the Yreka mining district. The dispute has arisen over the surveys of the claims.

SHOSHONE COUNTY.

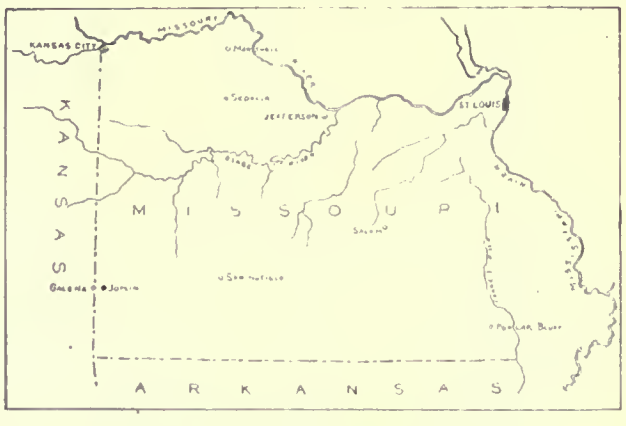
(Special Correspondence).—The Black Bear Fraction Mining Co. has resumed development, after a cessation of four weeks. An adit will now be driven on the 1400-ft. level, working three shifts. This property is considered one of the best prospects in the district near Burke. The ore-shoot has been exposed 250 ft. in the upper workings, and a large working adit from the railroad near the town of Black Bear has been driven into the hill a distance of 2455 ft., and has cut the vein of the Frisco-Morning ore zone. At present the face of the tunnel is about 150 ft. west of the upper adit, and drifting will now turn east to strike the orebody. Peter Bernier, president of the company, will take charge of operations

Burke, March 21.

MISSOURI.

JASPER COUNTY.

(Special Correspondence).—The unsatisfactory price of zinc concentrates during the past six weeks has caused the operators in the 'sheet-ore' camps of Webb City, Carterville, and Prosperity to allow a large surplus of ore to accumulate in the bins. The surplus is being constantly augmented by the additional mills that have started up in those camps. So great has this surplus become that the operators are again counseling the shut-down of the mills. In Prosperity camp the American Z. L. & S. Co., the largest producers in the camp, refuse to re-open the mines until the price of ore reaches at least a $40 base for 60% zinc. This company produces from 250 to 500 tons of zinc ore and from 50 to 100 tons of lead ore per week. In the Joplin camp the mills upon the Marion B. tract have closed down indefinitely. These mines are bonanza producers, and are among the heaviest shippers in the entire district. ——At no period in the history of the district has there been so much prospecting as during the past three months. The large companies that shut down the mills turned their attention to prospecting the ground they were working, while the men thrown out of work took up leases in the shallow ore camps and have prospected and extended the limits of these deposits. Among the new tracts thus developed was that of Elliot & Zimmermon, south of Webb City, where a drilling campaign was undertaken that resulted in the discovery of a body of sheet ore underlying a large part of 160 acres. Shafts have been sunk on three of the ten-acre sub-leases and two of these are now in ore running 4% zinc-blende. At two of the shafts concentrating plants will be erected during the summer.——Farther south, the Carnation Mining Co. has succeeded in opening a new run of ore on a ten-acre lease that has been developed by sinking three shafts into the orebodies found at the 160 and 240 ft. levels. The operators have taken an option upon 30 acres of the Cosgrove land adjoining the Church-Mitchell mine, and will drill the tract during the early spring months. A concentrating plant will be erected to mill the ores from the shafts already sunk.——On an adjoining tract the Martha E. Mining Co. has developed a ten-acre lease to the producing stage and has let the contract for the erection of a concentrating plant.——At Carthage, L. P. Benua has revived the old camp northwest of the city by drilling the land and discovering the heaviest run of lead and zinc ore ever penetrated by drills in the Missouri-Kansas district. The drilling showed ore from 35 to 198 ft. The ore in the upper levels was exceptionally rich pebble ore, while beyond 90 ft. the ore became disseminated in a brecciated black and blue chert. This has stimulated prospecting until there are drill-rigs at work on the Garlinger, Thomas, Porter, and Chautauqua lands.



Sketch Map Showing Position of Joplin.

Joplin, March 18.

KANSAS.

CHEROKEE COUNTY.

Northwest of Galena the United Zinc Co. has re-opened the old Playter mining camp and has discovered an extension of the orebody toward the northwest. Prospecting carried toward the east has also demonstrated the ore in that quarter. The company is developing the new finds by running out drifts from the old workings preparatory to re-opening the mills.——Southwest of the city, Horning and Shomon have developed leases on Spring river, where the drills showed a 16-ft. face of ore underlying a good portion of a 40-acre lease. The development of the lease

was carried forward by sinking two shafts. In this the water proved a hard problem, and it was only after installing a pumping plant of 2000 gal. per min. capacity that the shafts were finally put down into the ore. The pumps still have to handle 1000 gal. per min. to facilitate the drifting. The ore worked runs high in zinc, with a smaller percentage of lead. A concentrating plant will be erected. ——The Wyandotte land, southwest of the city, and for years one of the heaviest producers in that field, is again shipping ore. The water overcame the operators a few years ago, when through a cave-in the surface waters from a small stream flowed in, utterly filling the tract to the mouths of the shafts. So extensive were the workings down to the 60-ft. level that the task of pumping out the ground became too great for the small, unorganized operators, and the land was abandoned. Cush & Montgomery, with associates, have recently flumed the stream across the land and have erected a central pumping plant to drain the entire tract. Drilling has shown that there are yet two runs of ore below the old levels, at 100 and 120 ft., respectively. The water is now drained from the upper levels and many of the old mines have been sub-leased to small operators, while a number of large operators will exploit the lower levels.——Another tract just now being opened is the old Cooper Hollow tract of 40 acres. This tract has produced ore from the surface to 90 ft., but the pumping plant that drained the land was upon an adjoining tract and, operations being discontinued, flooded the other tract up to the 48-ft. level. Gerster & Sumner secured the land and have put up a pumping plant to drain it. The land is honey-combed with shafts, and over 20 leases have been let to small operators since the re-opening of the tract. Six big producers are located on this land, and the development afforded by the draining of the lower levels will add a large output to the present production of the Galena camp. ——The Ricksecker Bros., with their associates, have recently developed a six-acre tract of virgin ground in the fifth ward of Galena. The ore is zinc-blende and occurs at the 75 and 135 ft. levels. The ore runs 21% zinc-blende. The ore will be hand-picked and treated upon hand-jigs.

Galena, March 18.

NEVADA.

ESMERALDA COUNTY.

A carload of ore assaying about $90 per ton has been shipped from Stimler, a camp 25 miles southwest of Goldfield. A shaft has been sunk to a depth of 83 ft. and a pay-streak 3 ft. in width has been opened up. The shipment was made from Blair to the Nevada-Goldfield reduction plant.——The main shaft in the Mohawk has reached a depth of 600 ft., and the ore-shoot has been developed for 500 ft. on the 450-ft. level, and good ore occurs in both faces of the drifts. Cross-cuts have been driven and ore of shipping and milling grade is being blocked out. A winze is being sunk from the 450 level, and it shows 5 ft. of ore of shipping grade. This winze will be connected with a cross-cut from the 600 level.

HUMBOLDT COUNTY.

(Special Correspondence).—Much attention is attracted to Lone Mtn., or Kraimer hill, two miles southeast of Goiconda. The entire hill and the territory adjacent to it have been located within the last two or three months, and work on several claims has resulted in finding rich gold-bearing quartz in veins which strike nearly north and south through this quartzite hill. The mineralization appears to be along porphyry dikes, though the porphyry itself does not seem to carry gold. The discoveries were made by L. K. Kraimer, who located several claims for himself and his Kansas City associates. Subsequently, seven leases were let on the group, and on these considerable work is in progress. The most work has been done on the Oswell & Butts lease, where a 75-ft. shaft was sunk, from which some drifting was done, outlining a 12-ft. vein, in which the ore assayed $50 per ton. The gangue is quartz, through much of which free gold is disseminated. The Beldon lease, on the same lode, has a 50-ft. shaft, in which some equally good ore was found. Then comes the Weiland & Noe lease, on which work is in progress. E. J. De Lano and associates of Los Angeles have six claims of their own, and three others under bond, situated on the south slope of the same hill, where the croppings are conspicuous. They have a small force of men developing. Roach and Ryan, prospectors and miners, have some promising locations.

Goiconda, March 14.

(Special Correspondence).—While it cannot be properly termed a new district, Seven Troughs, from an economic standpoint, is still in its infancy. Discovered in the spring of 1906, it has gradually but steadily increased in population and progressed in development until at the present time there are seven properties recognized as proved mines, with three of these on the shipping list. There has never been a boom in this section. All work has been carried on in a quiet conservative manner, and while many properties are incorporated as stock companies, there has been less wild speculation and stock-jobbing than in many of the newer districts. The principal mines at this time are the Seven Troughs-Fairview at Vernon, Mazuma Hills, Kindergarten, Seven Troughs Therein, Signal Peak, and Fine Gold in Seven Troughs canyon, and the Little Hero at Farrell. Several other properties have prospects that give promise of developing mines. The Seven Troughs-Fairview is opened to a depth of 500 ft. A vertical shaft with levels at intervals of 50 ft. has shown the vein to continue to the lowest point of development. The lode is large with good milling ore, and has a 6-in. seam on the hanging wall of exceedingly high-grade material. On a recent run of 500 lb. of ore selected from this seam the net returns amounted to $3000. A carload shipment is now in transit to Salt Lake.——The Mazuma Hills Mining Co., the largest shipper to date, has sent to the smelter seven carloads of ore that runs well into the hundreds. A lode averaging 4 ft. wide and assaying more than $30 per ton is opened through two adits, each over 600 ft. long, and a winze to a depth of 90 ft. In all, the workings have reached a depth of nearly 300 ft. A 10-stamp mill is being erected by the company.——Lessees on the same property are also uncovering some good ore. On the Hayes-Reagan lease, a lode 2½ ft. wide was followed from the surface to a depth of 100 ft., and produced a carload of ore running over $300 per ton. Since this shipment a cross-cut from the 160-ft. level encountered a shoot of sulphide of high grade. A flow of water coming in soon after caused operations to be temporarily suspended at this point, but is now being handled by a 6-hp. Gould pump.——The Kindergarten has demonstrated to a depth of 200 ft. its three feet of $50 ore, and assures a steady run to the 10-stamp mill in course of construction. Three carloads of ore shipped last spring and summer has paid for the development of the mine and placed enough money in the treasury to liquidate all expenditures in the erection of the mill. The other properties mentioned have well defined bodies of milling ore in sufficient quantities to extract profitably.——While there has been no extensive geological research, it is generally accepted that the mineralized area is the result of extensive fissuring and shearing of the eruptive rocks. The ore-bodies occur as chimneys in the lodes formed on the contacts of a light yellow rhyolite and intrusive basalt, which is found in a series of parallel dikes having a north and south strike and varying in width from a few inches to several hundred feet. In the oxidized zone the vein-filling is a breccia resulting from the shearing of the rhyolite walls and re-cemented by an infiltration of quartz and limonite. This condition in most instances extends to a depth of from 100 to 150 ft. before the sulphide comes in with pyrite, arsenopyrite, and some stibnite. Ruby silver occurs, making the weight of silver about equal to that of the gold. Calcite occurs in the veins as an alteration product of the basalt walls.——The only exception found thus far to the general north trend of the productive veins is that of the Kindergarten, which extends into the Therien through the Stoker lease, in a western direction almost at right angles to the other lodes. Water has been the chief trouble for the small operator, but the larger institutions have no difficulty in disposing of it with small pumping plants, and it is generally conceded that the discovery of

water at no great depth will be an advantage rather than a detriment to the camp.——With two mills under construction and a custom plant promised in the near future, it is expected a steady production of bullion will be turned out in the next few months.

Seven Troughs, March 22.

LANDER COUNTY.

(Special Correspondence).—The Copper Canyon mine, situated 20 miles southwest of Battle Mountain, now the property of the Glasgow & Western Exploration Co., was operated as early as 1875, and was noted then, as it is now, for high-grade ore in the form of cuprite, with native copper. Shipments were being made till last November.——The Golden Era mine, 8 miles from Battle Mountain, is owned by J. H. Durst and C. A. Snow of San Francisco, the latter being in charge of the work now in progress. It is a gold property and has 1000 ft. of shaft and adit work. A gasoline engine is to be installed and a 10-stamp mill, for amalgamation and concentrating, will be installed during the coming summer. The group contains three parallel veins, all of which are being opened. The gangue is an altered rhyolite and porphyry, the gold therein being mostly free, although there is some calaverite. The country is diorite.——The Little Giant, adjacent to Copper Basin, 10 miles southwest of Battle Mountain is a silver-lead property, managed by J. C. Orwin and associates of Salt Lake. The ore is a carbonate and of high grade.—The Lucky Strike mine, at the head of Trout creek, is a new property, discovered a year ago, now owned by Salt Lake people, represented in Battle Mountain by E. P. Stevens. The ore consists of galena, accompanied by silver. Several cars of it were shipped that ran 65% lead and 80 oz. silver. They have four cars now ready for shipment. The vein is 3 ft. wide and is developed by a 100-ft. shaft.——Another mine in Copper Basin is the Pedro, purchased some time ago by Langley-Trimble Co. of Tonopah. It is developed by a 150-ft. cross-cut to the vein, on which is 100 ft. of drift. The vein, said to be 30 ft. in width, consists of quartz and porphyry carrying free gold, and iron sulphide containing gold. It is proposed to install a hoist and erect a mill. The former owners are Lemaire Bros., Lee, and McDonald. A new working shaft is to be sunk.——In Willow Creek canyon, parallel to Copper canyon, is the property of the Eldorado Gold Mines Co., the work being in charge of Alex Walker of Colorado. A new shaft is being sunk, over which a hoist will be installed. The ore is gold-bearing, a shipment of which last fall averaged $38 per ton.——In Galena camp, 14 miles south of Battle Mountain, is the gold and silver property of the British-Nevada Syndicate, on which some new work is to begin this spring. Galena was an active place in early days.——The Dean mine and mill, on Lewis Mtn., 18 miles southeast of Battle Mountain, are in charge of D. J. Bosfield, who carries on some operations each season. The ore carries gold, and the property was opened and the mill built several years ago.

Battle Mountain, March 18.

LYON COUNTY.

A contract has been let to the Kaeding Construction Co. of Goldfield to design and erect a 40-ton reduction plant for the Ramsey-Comstock Mining Co. of Ramsey, Nevada.

WASHINGTON.

FERRY COUNTY.

(Special Correspondence).—The Enterprise mining district has been organized, embracing an approximate area of 30 miles square, on the south half of the Colville Indian Reservation. It includes Meteor, Columbia, Hall Creek, and Twin Lakes camps. A. B. Nickens, of Covada, was elected recorder and will establish his office at that place.——The Faithful-Surprise Mining Co. has resumed active development work. During the past five years only the annual assessment work has been done. The mine has been opened by a shaft and two adits, intersecting and running on the vein, and the two levels are connected by a raise. About 1600 ft. of work in all has been done. The lower adit, when connected with the shaft, will give a depth of about 300 ft. on the vein. The company will drive a lower adit, to gain a depth of about 500 ft. S. L. Boyer has been appointed manager.

Republic, March 21.

OKANOGAN COUNTY.

(Special Correspondence).—The Nighthawk Mining Co. has purchased the mill, electric light plant, and Riblett tramway of the Grand View Mining Co. and removed them to the Nighthawk mine, on the Similkameen river, where they are being re-installed.——A small force is employed at the Ruby mine, and the company is shipping ore to the smelter.——The Judge Mining Co. is applying for U. S. patents for its claims on Palmer Mtn. The Judge group has considerable merit, but is idle at present.——The Triune mine, in Golden camp, is to be worked by a larger force.

Gold Bar Mine and Mill, Near Rhyolite, Nevada.

It has produced considerable high-grade gold ore.——The Bank of Montreal is reported to have sold to New York people the Dividend mine, comprising five claims on the west bank of the Similkameen river, about three miles north of Oroville. The property, for a long time idle, has been opened by over 200 ft. of adits, drifts, and raises, and considerable backs of ore are ready for stoping. A large tonnage of ore on the dumps is ready for treatment. With the mine is a 10-stamp mill on the east bank of the river, equipped for concentrating, amalgamating, and cyaniding. The Owasco Gold Mining Co. is said to have been organized to take over the property, and will shortly begin to operate it on an extensive scale. The mill will be overhauled, and will be operated by electric power.

Nighthawk, March 23.

CANADA.

BRITISH COLUMBIA.

The recent developments of good ore on the lower levels of the Centre Star and War Eagle, and the favorable results of diamond drilling, have made it necessary to continue the present workings to greater depths. The main shaft is to be deepened from the 14th to the 16th level, which will give a total depth of 2400 ft. on the lode. Good ore has been found on the Blue Bird, which is now 4½ ft. wide in a well defined vein.——The following ore shipments have been made during the week: Rossland mines: Centre Star, 3512; Le Roi, 1680; Le Roi No. 2, 665; Evening Star, 35 tons. Boundary district, 24,440; Slocan-Kootenay district, 1622 tons. The smelter receipts are as follows: Granby, 24,440; Trail, 4765; Le Roi smelter at Northport, 1444 tons.

Special Correspondence.

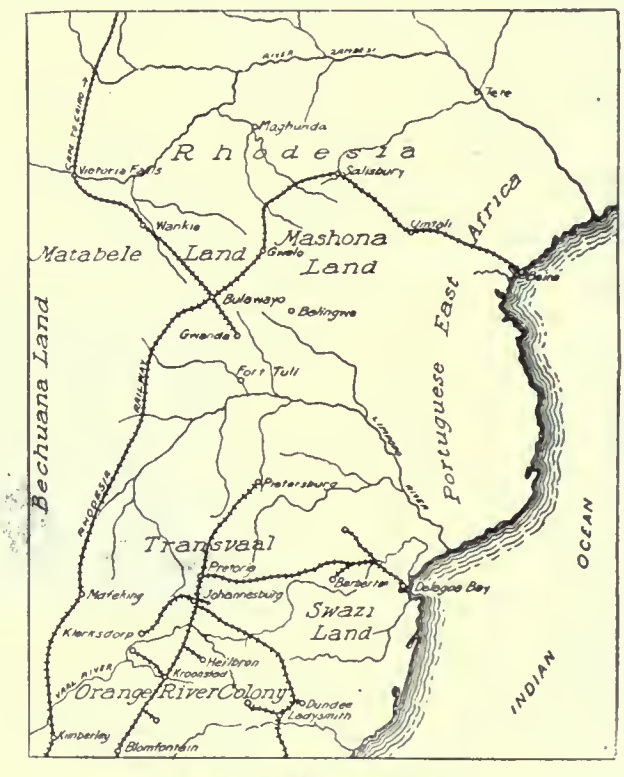
LONDON.

Consolidation of Farrar Group.—Rand Finance.—The Edward Medal.—Exploration Co.'s Bad Luck.—Australian Smelting Corporation.

For several months it has been known that the companies constituting the Farrar group, working east of Johannesburg, were to be amalgamated, if a scheme could be arranged that would be likely to suit the shareholders of the various companies. Such a scheme has now been put forward, and as it has met with the approval of some of the leading shareholders, there is every probability that it will be accepted generally. The Farrar group consists of the East Rand Proprietary Mines, which is the parent company; the H. F. Co., which has an interest in the East Rand Proprietary entitling it to 25% of the profits, and nine subsidiary companies owning and operating individual mines, namely, the Cason, Angelo, Dreifontein, New Comet, Cinderella, New Blue Sky, Angelo Deep, Dreifontein Deep, and Hercules. The first four are producers, and their outputs during 1907 were respectively, in ounces of gold: 190,975, 159,582, 104,489, and 91,578, while the other five are in process of development. The scheme for amalgamation is to increase the share capital of the East Rand Proprietary from £1,000,000 to £2,500,000 and to give certain proportions of new shares in exchange for shares in the subsidiary companies. The shareholders in the H. F. Co. will receive 333,333 new East Rand Proprietary shares. The shares due to holders in the subsidiary companies will be exchanged according to the relative present value of the several shares. The East Rand Proprietary is, of course, a large shareholder in the subsidiary companies, but these shares are canceled in the amalgamation. The market value of the East Rand Proprietary shares is taken at £3 13s. 9d., and that of the Angelo at £3 7s. 6d. There are 625,000 Angelo shares, of which 427,580 are held by the East Rand Proprietary. The remaining 197,411 shares are held by other people, who will receive in exchange 180,681 of the new shares. It is not necessary to go through the similar details of the other companies, so I will sum up by mentioning that the total new shares to be issued are 1,405,897, leaving 94,103 of the new shares held in reserve for future issue. Arrangements are also made whereby the new shares given to the shareholders in the non-producing companies shall not rank for dividend for a year or more, according to circumstances. There are a number of advantages to be gained by consolidating these interests. For one thing, the non-producing subsidiaries will be placed in a position of affluence by the possession of working capital obtained from the producing mines. It has been found difficult to raise funds for the development of the non-producers, and this consolidation of interests will make the whole group self-supporting. The scheme also will make for economy both in business organization and staff, and in the methods of handling the ore.

The first Edward medals were awarded this week to two miners, one from Newcastle district and one from South Wales, for bravery in rescuing comrades at the imminent risk of their own lives. This new decoration was instituted last summer by the King, and the announcement relating to it was made during his visit to Cardiff. The medal ranks equally with the Victoria Cross, and may be awarded to miners in any part of the British Empire who show conspicuous bravery. The medal is to be presented personally by the King, if in Great Britain, or by his governors, if in a colony or dependency. These are the days of cheap sneers at sentiment, and many superior persons think lightly of human emotions. It is well therefore to thank the King for the institution of this decoration and for his readiness to receive personally the humblest among his subjects. There are over a million men in Great Britain engaged in mining operations, mostly in connection with coal mining, the most dangerous of all branches of this work. They carry their lives in their hands, not knowing, when they descend, whether they will return. Apart from the danger, their occupation is also both arduous and unattractive. The miner is often of rough exterior and of uncouth speech, but is full of genuine emotions and ever prepared for self-sacrifice. So, for once in a way, let us forget the sordid laws of political economy and give a few kind thoughts to the heroes of the mine.

The melancholy state of the mining market is well reflected in the report for 1907 just issued by the Exploration Company. With the exception of



Map of the African Goldfields.

the El Oro and Tomboy companies, everything has been going wrong with the investments and speculations of this company. Mining men are all sorry for Mr. R. T. Bayliss, the chairman, and that the force of circumstances should have gone so much against him, especially as the chairmanship of the company was not sought by him. He took it some six years ago as a matter of duty, with the hope of repairing the damage done by previous managers and putting the company once more on its legs. During the last few years the profits have unfortunately been largely reduced by the recurring necessity of writing down the assets on account of depreciation, but during 1905 and 1906 there were sufficient balances of profit to enable the company to declare 5% dividends. The year 1907 was more disastrous still, for not only was it necessary to provide for depreciation, but losses were made on the ordinary transactions. The losses due to depreciation amounted to £158,418, of which £73,418 was due to the decline in South African gold mining shares and real estate, and £85,000 due to the depreciation in various copper company's shares, chiefly Amalgamated and other Montana companies. In the profit and loss account there is also an item of £56,000 due to losses on realization of some of these copper securities.

Another item of loss was £18,428 expended on the Maravillas copper mine in South America, which had to be abandoned. The net loss on the year's revenue account was £32,458. The outlook for the company is at present decidedly blank.

In your issue of February 1, I gave an account of the threatened reconstruction of the Australian Smelting Corporation, and mentioned that there were some hopes of the shareholders escaping assessment after all. These hopes are apparently being justified, for negotiations are taking a satisfactory course for the subscription of the necessary money in Australia. A scheme has been formulated which is to be submitted to the shareholders and debenture-holders. The terms are rather severe on both classes of present holders, and in all probability there may be some who would prefer the assessment. The scheme provides for the formation of a new company, of which the nominal capital shall be £70,000, in 140,000 ordinary shares of 10 s. each, 125,000 of 7% cumulative preference shares of £1, and £100,000 of 5% mortgage debentures. The 140,000 shares of 10 s. each are to be given to the holders of the 140,000 ordinary shares in the present company. The holders of £87,000 debentures in the present company are to receive £65,250 in debentures in the new company. The Australian people, whose names it is not desirable to divulge as yet, are to subscribe for the remaining £34,750 of debenture and £75,000 of the preference shares, thus providing the company with £109,750 in cash. The remaining 50,000 preference shares will be under option to the subscribers for two years at par. It remains to be seen how this scheme will be regarded by the shareholders and debenture-holders.

GOLDFIELD, NEVADA.

A Custom Plant.—Cyaniding in the Mortar.—Concentration.—Tube-Mill.—Filter-Presses.

The mill of the Nevada Goldfield Reduction Co. is treating 100 tons of ore per day, most of which comes from Goldfield mines, though a small tonnage is brought in sacks from Rawhide. A description of the plant may be of interest, as the present arrangement and method represents a considerable change from those of a year ago. The crushing and sampling department does not depart essentially from that seen in other sampling plants. The mill operates as a custom plant and the sampler is an important feature. The ore passes to the mill proper reduced to one-inch size and finer. It is fed through automatic feeders to four 5-stamp batteries of 1250-lb. stamps, discharging from the mortars through 16-mesh screens. The battery water consists of a dilute cyanide solution. The pulp flows thence over amalgamating plates, on which the recovery of the gold and silver ranges from 7 to 50%, according to the character of the ore. From the plates the material passes to Wilfley tables, the concentrate from which is mostly a heavy clean sulphide. These tables are so arranged as to yield a fairly good separation of the sand from the slime. The sand is reground in a tube-mill, which reduces it to 100-mesh, discharging upon a second set of amalgamating plates, thence by Frenier pumps to V-shaped classifiers. The heavier product discharges through the bottom of the classifiers to a series of vanners. The overflow from the classifiers passes to slime-vanners. The slime that is parted from the sand on the Wilfley tables also passes to the plates, on which it joins the tube-mill product. The sand passing over the vanners makes a light low-grade concentrate from the oxidized ore and a heavy high-grade concentrate from the sulphide ores. The tailing and middling from these vanners pass to the sand-vats for leaching; the slime-vanners, which handle the overflow from the classifiers, make a flocculent concentrate and pass the tailing to the agitator-vats. There are eight sand-vats and four agitator-vats. When the material reaches these, the solution receives additional cyanide. The agitator-vats are each 22 ft. diam. and 20 ft. deep, the agitating being effected by mechanical stirrers and centrifugal pumps. The slime from the latter is passed to a storage vat and thence to Butters filters. The solution from the filters is clarified by passing it through a Davis filter-press before it flows to the zinc-boxes. The precipitate is treated with SO_2 gas to take up the zinc. The mill contains an auxiliary plant for treating high-grade ore and for material requiring longer than the usual time for leaching. E. S. Leaves is general superintendent, and A. M. Smith mill superintendent.

Nevada-Goldfield Reduction Co.'s Plant.

Mizpah Shaft of the Tonopah Mining Co.

It is understood that after careful tests C. W. Merrill has decided that the filtering device used by him so successfully on Homestake ores is unsuited to the Goldfield ore. The tests were made at the plant of the California Ore Testing Co., in San Francisco, with the co-operation of F. L. Bosqui, who is acting as consulting metallurgist to the Goldfield Consolidated Mines Co. Labor conditions have improved very much, and it is expected that the construction of the new mill, furnished by the Allis-Chalmers Co., will proceed rapidly.

JOHANNESBURG, TRANSVAAL.

Gold Output.—The Labor Supply.—An Earthquake. —Keir Hardie.—Revision of Gold Law.

The returns for January show that the output of gold for the month was 560,329 oz., valued at £2,380,-124, which is a decrease of £98,535 compared with December. There was 40,000 oz. of gold, however, in the December declaration which really belonged to the reserve account, so that for actual production the January output was really 17,000 oz. ahead of December. The Rand's production was 540,202 oz., valued at £2,294,632. During the month there were 8775 stamps at work in the Transvaal, of which 8410 stamps were running on the Rand. The following figures are eloquent of the remarkable advance of the Rand since the end of the war. The total yearly production is as follows:

	Oz.	£
1901 - - -	288,994	1,014,687
1902 - - -	1,707,601	7,253,665
1903 - - -	2,995,749	12,589,248
1904 - - -	3,779,621	16,054,809
1905 - - -	4,897,221	20,802,074
1906 - - -	5,786,617	24,579,987
1907 - - -	6,451,384	27,403,738

The premier position for January is taken by the Simmer & Jack mine, with an output of 25,383 oz., valued at £107,820; second on the list is the Robinson, with an output of 25,304 oz., valued at £107,485; the third producer is the Robinson Deep, with an output of 20,592 oz., valued at £87,469. The labor position for January is quite satisfactory, as all of the departing coolies have been replaced by Kaffirs. There appears to be no danger of an immediate shortage of labor. The extra efforts being made all over the country have something to do with the satisfactory state of the labor market, but the real cause is the fact that the depression which has hung over this sub-continent so long, resulting in considerable retrenchment in industrial, commercial, and municipal undertakings, has led to the gradual concentration of natives from all parts of the country to the only work left for them, namely, on the Rand gold mines. There has been considerable curtailment of operations in the diamond mines, and at De Beers alone 7000 less natives are now at work than were employed a year ago. It is to be feared that the very satisfactory state of the Kaffir labor market on the Rand is temporary, and that the danger of a shortage is still with us. It is this very uncertainty of the labor supply that does so much to keep the Rand back.

It is now believed that the Rand can boast of a genuine earthquake tremor. Some nights ago there was a distinct shock felt in the Central Rand by many people. It was explained on the supposition that there had been a big fall of rock in one of the mines, and the Village Main Reef mine was selected as the scene of the eave. The manager, however, stated that no fall of hanging had taken place in the mine, and that another theory must be sought. Unfortunately, there is no seismograph on the Rand, but it is now generally held that there was a slight earthquake tremor.

So far, Keir Hardie, one of the labor leaders of England, has met with a warm reception on his visit to South Africa. In Durban the meeting was so rowdy that he was not allowed to speak. When he appeared on the platform he was greeted with yells of "Traitor," and the noise was so deafening that no one could speak. He was escorted back to his hotel by a strong body of police. There is no question of the unpopularity of Keir Hardie in South Africa. He is considered a meddling ignorant sentimentalist, and the labor leaders showed very poor judgment in asking him to come here. It is expected that his reception on the Rand will be almost as warm as in Durban. Whether he has come out with the idea of working up another strike is not known, but if he proves as complete a failure as the imported Australian agitators, there is little fear of trouble in the future. The men have had enough of striking for a while.——The discussion over the revision of the gold law has commenced, and it is probable that when the question is brought up at the next session of the Transvaal Parliament, there will be many important additions to the law. It is felt that there should be greater rewards for prospectors, and that the law should be framed so as to give the 'poor man' more of a show in the mining of the country. ——What will probably rank as one of the worst mine accidents in South Africa has just occurred at the Glencoe colliery in Natal. All the facts have not yet reached Johannesburg, but it looks as if 72 lives will be lost through this disaster—12 Europeans and 60 natives. A telegram from the manager of the colliery attributes the disaster to an explosion of fire-damp. After the first explosion rescue parties entered the mine, but unfortunately there were further explosions, and the rescuers were entombed. Among the rescuers was W. Muir, the deputy Commissioner of Mines.

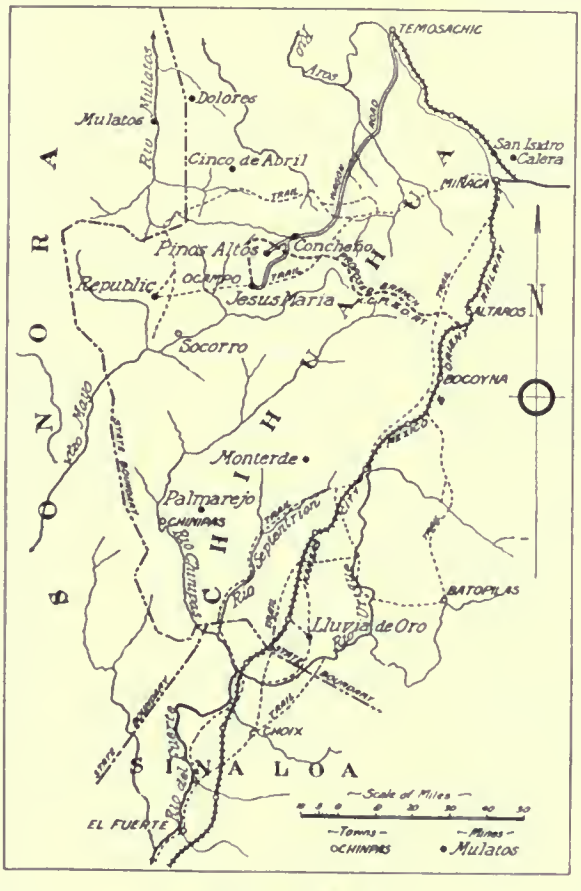
GUAYMAS, MEXICO.

Railroad Building.—The Yaqui & Pacific.—Hasty Construction.—Kansas City & Orient.—The Calabacillas Mine.—Lluvia de Oro.—Activity in Sinaloa.

The building of the so-called Cananea, Rio Yaqui & Pacific Railroad is proceeding rapidly. That is, 'rapidly' for Mexico. Considering the remarkably easy country through which the road is going, no records are being made at all comparable with those made by the transcontinental roads in Montana some twenty years ago. The rail-head is now about 30 miles south of San Blas, the junction with the Kansas City, Mexico & Orient road. At the time of writing the road is only opened as far as Navajoa, on the Mayor river. The Alamos branch has been open for some months. It is reported that construction is being pushed both north and south from Mazatlan and Culiacan, and that fair speed is being made. So far as can be learned, construction goes forward from six heads in the Sinaloa-Sonora section, two heads from Mazatlan, two from Culiacan, one from San Blas, and one on the Yaqui river branch. Owing to the absence of real newspapers in Sinaloa, it is very difficult to learn the actual condition of affairs. My own observation indicates that the preliminary construction is crude, all cuts more than a metre deep being 'shoo-flied,' and gulches crossed on cribbed ties. The efforts seem to be concentrated on moving the rail-head forward, and the exigencies at the front keep the rails so constantly occupied that the completion of the line behind is slow.

All work on the Kansas City, Mexico & Orient Railroad in Sinalao has been suspended for some months. Grading has been completed as far as the Choix river for a long time, but traffic is opened only as far as Joyaneo or the Fuerte station. This station was established several years ago, and since then little effort has been made to push construction. To those working in the Distrito del Fuerte this is a matter of great regret, as a number of mines would now be working if transportation facilities were improved. The completion of the road to the Choix river would also greatly help the mines of the high Sierra in getting access to the Pacific Coast markets. This much needed improvement in transportation is not looked for this year.

It is feared that the sale of the Calabacillas mine may not be consummated. The final payment became due when the panic of last autumn disarranged so many financial plans in the United States. It will be a matter of sincere regret to the many friends of W. A. J. Underwood, one of the active promoters of the enterprise and the actual manager, if the sale does not go through. The option was obtained on favorable conditions and the development of the mine showed promising results. Normally there would have been no difficulty in raising the funds necessary for compliance with the terms of the option. The mine contains, in addition to the new ground opened up by Mr. Underwood, large reserves of low-grade material left by the Mexican owners in their gophering for the high-grade streaks. Mr. Underwood has worked like a Trojan for the last two years on this enterprise, and all hope that he



Map of Part of Mexico.

will succeed in putting the deal through.——It is reported that Messrs. George Holmes and White have secured control of the Guadalupe mine at La Cumbre de San Manuel. Mr. Holmes is working about 100 men preparing to transport the ore over a wire-rope tramway to the Poche mill. The ore is to be treated by amalgamation and cyanidation. The management of the Lluvia de Oro is wrestling with the transportation problem in assembling its new equipment. A tremendous amount of material yet awaits shipment from Joyanco to the mine. A wagon-road was recently completed from Choix to the Fuerte river. The machinery is being carried to the river and is then rafted some miles up-stream to the foot of a narrow wagon-road that winds down the side of the barranca from the mine. The equipment is very heavy, and it is considered improbable by local people that the building of the mill will be completed this year.

It is reported that once again the Jesus Maria mine at San José de Gracia is in bonanza. These mines are periodically reported as being worked out, but apparently they never give the last gasp. It was stated by an official connected with the company that at the present time the bullion shipments amount to $100,000 monthly.——In spite of the financial flurry in the United States, a number of American companies continue exploration, and apparently with satisfactory results. The Sierra Madre M. & D. Co. is working at Pino Alto, Sabinito, and Las Yedras. Harry Maude is working at Los Cueros and some Denver people are investigating property near Placeres, on the main Calabacillas and Fuerte trail. A number of Americans are prospecting in the Fuerte and Morelos districts, whether for themselves or for companies is not known.

SALT LAKE, UTAH.

Revival at Mercur.—Other Gold Districts.—The Newhouse Co.—Tintic Smelter.—Utah Copper Co.—Shipments From Tintic.

There are indications of a revival in the Mercur district; the announcement of a resumption at the Sunshine mine has served to renew confidence in the low-grade gold properties of the camp. Several years ago, the Overland mine was operated successfully for a time, but it finally proved to be a failure owing to refractory conditions found at depth. The Sacramento Co. is doing exploratory work with the hope of finding new bodies of the cinnabar ore that has been so profitable in times past. The Consolidated Mercur is, of course, the mainstay of the camp, and is producing about 800 tons of ore daily, from which is being recovered between $30,000 and $40,000 monthly.——The newest gold camp in the State is Gold Springs, in Iron county. The Jenny Co. is conducting the principal work at the present time, and is operating a small mill. At Stateline, a few miles away, there are symptoms of a decided revival. Here lessees working in the Ophir mine are meeting with success. In the Deer Lodge district, which is really a portion of the Stateline and Gold Springs mineral belts, but situated just over the line in Nevada, several new companies have been formed recently and are preparing to undertake active development. Salt Lake and Eastern parties not long ago acquired title to the Snowflake and other properties, in the name of the Buck Mountain Mining & Milling Company.

Local minority shareholders, representing 44,700 shares in the Newhouse corporation, have requested representation on the board of directors, and assurance has been given by Samuel Newhouse that the same will be granted. Accordingly, ex-Governor Heber M. Wells has been invited to become the representative, and he will undoubtedly be chosen at the next annual meeting, which occurs in New York on the 27th inst. During the conference with Mr. Newhouse, Lafayette Hanchett, the manager, explained that at the present time the company is marketing 600 tons of ore daily and producing copper on the basis of 600,000 lb. monthly, but that the output will shortly be increased to 1,000,000 lb. The mine is opened to the 800-ft. level, and there is no reason to doubt that it is one of the most valuable copper mines in the State.

The annual report of the Carisa Mining Co., operating in the Tintic district, has been issued, and shows net earnings last year of $78,649, obtained from 7,481 tons of ore. The smelting companies were paid $31,320 in treatment charges; the railroads received $30,054 for freights, while $34,614 was paid out for labor. The physical condition of the mine is reported as being fairly satisfactory; but the management recommends exploratory work below the 1000-ft. level. Except the ore taken out by lessees, no shipments have been made this year on account of the low price of metals.——The construction of the new Tintic smelter is progressing at a most satisfac-

tory rate, and the fact that the management has ordered equipment sufficient to operate a plant twice the size originally planned indicates that the builders are embarking in the smelting business upon a much more elaborate scale than was originally intended. As now planned, the Tintic plant will treat 800 tons of lead and 300 tons of copper ore daily by the end of June. The Minneapolis Steel & Machinery Co. has been awarded the contract for the steel building to contain the copper furnaces. The plant is to be thoroughly modern and complete in every respect. The company has begun to look around for contracts and has already tied up some of the principal producers in the Tintic district for a term of years. A representative has also been looking for tonnage at Pioche, Nevada.

The Utah Copper Co. oversold its spot copper in February to the amount of nearly 4,000,000 lb., or about what the March output of its mines will be. The ninth section of the mill at Garfield is now in commission, and the plant is treating 4500 tons of ore daily. Six steam-shovels are being employed at the mine, and they are moving between 11,000 and 12,000 tons of ore and overburden daily. The seventh shovel has been ordered.——The Boston Consolidated management is rapidly getting ready to supply ore to the mill at Garfield. On account of the shut-down last autumn much valuable time was lost. However, three sections of the Garfield mill are running, and the fourth will be started early in May.

The ore shipments from the Tintic district last week amounted to 49 carloads, the contributing mines and amounts being: Centennial Eureka, 44; Eureka Hill, 4; Bullion Beck, 1 carload.——The May Day mine will resume production next week.

GOLCONDA, NEVADA.

An Interesting Concentrator.—Gravity Not Used.—Description of Apparatus.—Excellent Results.

The concentrating plant of the Glasgow & Western Exploration Co., at Golconda, Nevada, is now operated by the American Direct Concentration Co., having been equipped with the devices of the latter company for separating the pyrite from the lime-garnet gangue by a method that is the reverse of gravity concentration on jigs and tables. This company is controlled by A. P. Stanley Macquisten and associates, who are also connected with the Glasgow & Western. The ore being run through the mill comes mainly from the Adelaide mine of the Glasgow company, 12 miles southeast of Golconda, and contains chalcopyrite running 4% copper. The ore is crushed to an average of 30 mesh by crushers, rolls, and Huntington mills. In the sizing and re-grinding and classifying that the pulp undergoes, the fine slime is separated from the sand and heavier pyrite by spitzkasten and Callow tanks, this slime being laundered down to settlers, the settled product being shipped to the smelter. The sand and its accompanying pyrite are then subjected to a flotation process, whereby the surface tension of the water that goes with the pulp causes the mineral to float and pass over the lip of a receptacle, while the lime-garnet waste settles, effecting a remarkably clean separation of the two. The equipment employed consists of 96 cast-iron tubes, each 6 ft. long and 12 in. diam., the interior of the tube being spiral. These tubes are arranged in 24 units of 4 tubes to each unit, all set horizontally. The four of each unit are placed end to end, the second being on a lower level than the first, the third lower than the second, and so on, permitting a continuous flow of pulp through the series. The tubes all revolve at the rate of about 30 rev. per min. The pulp, carrying with it a liberal supply of water, is fed into the head end of the first revolving tube, whose spiral corrugations carry it to the opposite end, where it discharges into an iron sand-box which constantly overflows, carrying the mineral with it. The flotation of the mineral on the surface of the water begins as the water and sand discharges from the tube. The sand settles at the bottom of the sand-box and passes through a spigot into the second revolving tube, then to the third and fourth of the series, each tube making a concentrate of its own. The first tube in the series makes approximately a 25% copper concentrate, the second 20%, the third 15%, and the fourth a 10% product. It is interesting and instructive to see the 24 units working, each enacting primary concentration, followed by three re-concentrations. The final tailing is remarkably clean, and the product has the consistence of a clean concentrate. The principle on which this method depends is the recognized surface tension of flowing water, but this is aided to some degree by making the water slightly acid by putting into it a small quantity of sulphuric acid. The addition of a little coal oil has been tried, and perhaps to some effect, but the mill superintendent, C. G. Smith, asserts that this is no really essential feature of the process. The process and the equipment necessary to its demonstration were worked out and devised by A. P. Stanley Macquisten of the Glasgow & Western Co., operating in Nevada, Utah, and Mexico. This company has a reverberatory smelting plant at Golconda, which may be re-modeled and equipped for modern copper smelting at a later date.

The Western Pacific, building from Salt Lake to San Francisco, has 230 miles of track laid from Salt Lake, 170 of which is in Nevada. The line first strikes the Southern Pacific at Wells, and continues in close proximity to the latter as far as Winnemucca. From there it strikes westerly, going around the north end of Pyramid lake, thence southerly a distance of 60 miles, then turning westerly, crossing the Sierra Nevada over Beckwith pass, which is 1900 ft. lower than the pass over which the Southern Pacific crosses this range near Truckee. The route goes thence down the middle fork of Feather river, then through a 7000-ft. tunnel into the north fork of the same stream, continuing through Oroville and Marysville, thence to Sacramento and San Francisco. The grading is complete 110 miles west of Elko. In making the detour south from the head of Pyramid lake this line comes within 20 miles of Reno.

Charles A. Green, who is mining high-grade antimonial ore in Bloody canyon, 14 miles from Mill City, has installed a 6-ton reverberatory smelting furnace at the property, which is ready to be blown in. His work in the mine shows 210 ft. vertical depth of ore, which occurs in lenses in the vein. In 1907 he shipped 450 tons of this ore on a guarantee that it would run at least 60% antimony, and it ran above that percentage. This ore is a sulphide, free from arsenic and other impurities except sulphur. Wood from the desert and canyons will be used as fuel for the furnace.——W. G. Adamson and associates, of Winnemucca, are developing properties of cinnabar ore in American canyon, El Dorado canyon, and in the Antelope range, north of Rosebud. Some excellent specimens of this ore have been brought to Winnemucca.

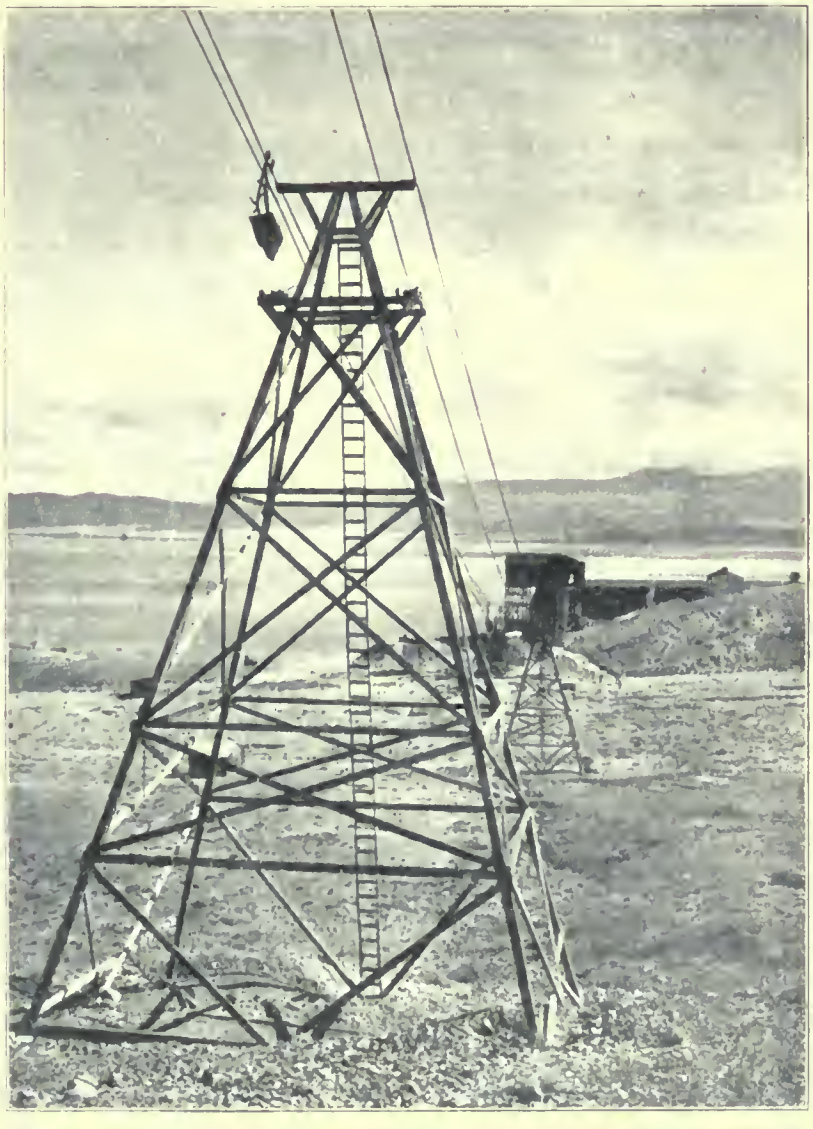
The Nevada Northern Copper Co., of South Dakota, has a location of 17 claims in Sonora range, 12 miles southeast of Winnemucca, and J. C. Fuller and David Payne, stockholders in the company, are on the ground doing some work. An adit is being driven on a vein of copper ore between limestone and porphyry. The gangue consists of shale, carrying copper, silver, and gold. The ore is a sulphide, in which native copper is visible. The mountain is high, and great depth can be attained by driving a short distance on the vein.

TONOPAH, NEVADA.

Pittsburg-Silver Peak Co.—Tramway and Mill.—Character of Ore.—Golden Circle.

The property of the Pittsburg-Silver Peak Gold Mining Co., at Blair, is just beginning the period of production for which preparations have been in progress during the past 18 months. The mine is well developed and equipped and the new 100-stamp mill is ready to operate at its full capacity. The Leschen aerial tramway, 2½ miles long, has a line of 124 buckets of 10 cu. ft. capacity, supported by steel towers, so that it can carry 40 tons of ore per hour. The mine terminal is 1600 ft. higher than the mill, the speed of the buckets being regulated by an oil-controller at the upper end.

The mine workings comprise those of the Mary, Mohawk, and Drinkwater, which originally were separate mines. Since their purchase and consolidation by this company the workings have been connected by 3600 ft. of adits and cross-cuts on the main working level, which is equipped with electric haulage. The three mines, now connected and operated as one, were locations on different parts of the same great vein, which strikes northwesterly through a schist and diorite, accompanied by dikes of alaskite. The vein has a dip of but 18 to 20° from the horizontal, and is estimated to have an average width of 10 ft. throughout the length of this group. Worked-out chambers and the faces of some of the stopes show the vein to widen to 30 and 40 ft. in places. The ore consists of a gold-bearing quartz, having practically no sulphides, those which do occur being iron and galena in small seams and pockets in the gangue. The Mohawk takes in a portion of the vein higher than the others and covers the apex; the Drinkwater was located still lower on the dip of the vein and farther northwest; the Mary, through which the main adit enters, occupies the lowest place on the dip of the vein. All the ore now exposed and blocked out stands above the haulage level, and the workings above it open 800 ft. of ore, measured on the dip. Present plans contemplate the sinking of an incline on the vein from the lowest level.



Steel Tower of Leschen Tramway of the Pittsburg-Silver Peak Gold Mining Co., at Blair, Nevada.

At the portal of the main adit a small electric-driven air-compressor is in use, and a 20-drill Nordberg compressor is being installed. The latter will be driven by a 300-hp. electric motor. This will give the company sufficient drill-power to break the large tonnage of ore required at the mill and to keep up development.

The ore is hauled from the mine in 3-ton cars direct to the bins, which discharge into the crushing plant, the latter consisting of a No. 6 and two No. 3 McCully gyratory crushers, reducing ore to 1½-in. size. The crusher plant and the upper tramway terminal occupy the same building. The crushed ore falls into bins, from which it is drawn through a chute, below which is an automatic loader for filling each tramway bucket as it passes that point. At the mill terminal the ore is distributed by a 180-ft. belt conveyor to the bins above the batteries. The latter are divided into five 20-stamp units, a 50-hp. electric motor supplying the power. The stamps are 1050 lb. each, dropping 7 in. 104 times per minute, the mortar screens are 35 mesh, of both the slotted and perforated steel type. It is figured that from 60 to 70% of the assay-value of the ore will be recovered on the amalgamating plates. The pulp from the plates flows to two main cone-classifiers, thence to a second set of ten cones. The overflow in each case passes to pulp-thickening vats, the heavy material to sand-vats. This feature of the plant consists of the Merrill system of cone-classifiers, whereby a good separation is made of sand from slime, the sand being cyanided in vats and the slime in the Merrill filter-presses. The precipitation is effected by zinc dust and the precipitate is collected in a triangular press.

There are 125 men employed at the mine. George O. Bradley is general manager; the mine superintendent is Geo. Skeavington; cyanide superintendent, Henry Hanson; foreman of stamp-mill, M. O'Rourke.

Gold Circle, in Elko county, is 50 miles northeast of Goleonda and about the same distance north of Battle Mountain. People are rushing into this camp by stage and automobile from Goleonda and Battle Mountain. Some also go in from Tuscarora. The new camp is close to Midas postoffice, which was established long before the ore in the adjacent hills attracted attention. The veins opened carry free gold in a quartz-porphyry gangue, and many rich specimens are brought out.

Concentrates.

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

A second-foot is a flow of 1 cu. ft. per second, and is equal to 50 miner's inches. At Niagara the discharge is about 250,000 second-feet.

In the scorification assay, with mixture of pure silver and lead, an increase in the amount of silica present makes the loss of silver greater in the slag.

Bucket elevators have been used for elevating tailing, but are not satisfactory because the sand adheres to the buckets and wears the links.

The efficiency of the air-lift is dependent on the ratio of submersion to lift, and accordingly a double lift is economic in many cases to avoid expense in obtaining submersion.

A screw conveyor is the cheapest of all conveyors to install. A 9-in. screw, 100 ft. long, ought to be put up for about $300. All parts are subject to heavy wear, and repairs and renewals may easily amount to 100% per annum.

Aluminum is the most abundant of all the metals. It is an essential constituent of all important rocks except sandstone and limestone. The metal is expensive to reduce, the process being the electrolysis of bauxite dissolved in fused cryolite.

Structural steel encased in good concrete is safe from corrosion for many years, but in the case of cinder concrete, the voids often cause corrosion. If cinder concrete is to be used, it should be mixed well and wet, and it may then be trusted as much as stone concrete, so far as corrosion is concerned.

The ordinary pile-driver cannot be much improved in the matter of capacity. Steam drivers are successfully used, but the shorter period taken in driving does not materially affect the total capacity of a crew. The main cause of the limited output in driving piles is the length of time necessary to adjust the pile and the machine to the position required.

Tar and gravel covering is generally put on a roof of 1-in. boards laid on rafters, or else 3-in. plank, grooved and splined, laid directly on the roof girders. In making the roof, several layers of saturated wool felt are first put on, and then the surface is finally covered with coal tar pitch and a sufficient body of well screened gravel to give the desired surface.

Platinum occurs in certain copper-nickel ores of low grade in southwestern Utah and eastern Nevada. Near Bunkerville, in Lincoln county, Nevada, the occurrence is similar to that in the Sudbury district. The ore is said to contain 2½% of nickel and ⅓ oz. gold per ton, in addition to some copper. The deposits are situated 45 miles from Moapa station on the San Pedro, Los Angeles & Salt Lake railroad.

Placer ground has been profitably worked when only containing 2.52 c. per cu. yd. for the total material washed. In one case in northern California the amount of material washed down was 1,251,399 cu. yd., yielding $31,618. Of this amount, 86.5% of the gold was obtained from the sluices, 12% from the bed-rock ditches, and 1.5% from undercurrents. The profit obtained was $4106, as a result of nine months' work.

Whenever metal is subjected to corrosive gases in smelter buildings, the ordinary allowable stress should be decreased 20 to 25% and the minimum thickness of metal increased 25%, unless it is fully protected by an acid-proof coating. The minimum thickness of corrugated sheet steel for roof-covering should be No. 20 gauge, but where there is no danger of corrosion, No. 22 and 24 may be used for the roof and sides, respectively.

Dams in underground workings may conveniently be made of timber. A recess with smooth sides is cut in the drift, and horizontal balks of timber, preferably of oak, are carefully fitted in. These should be dressed and all cracks caulked. For this purpose shingles, driven in the inner side of the dam, are effective. For heavier pressures a special dam made of wooden logs placed longitudinally and wedged tightly is more effective than masonry dams, which are liable to crack if movements of the ground occur. Concrete dams are easily put in and are better than masonry work.

The drilling of oil-wells in California cannot be performed economically, owing to the hard shells which occur in the soft rocks. These must be passed through at an angle, which has a tendency to change the direction of the holes, causing much expense and trouble from crooked and caved holes. The machinery is heavier than that used in other districts, and thicker casing is necessary. In the Coalinga field, wells between 2000 and 3000 ft. deep cost from $20,000 to $30,000. The principal developed oil areas of California are in Kern and Fresno counties in the San Joaquin valley, and Santa Barbara and Los Angeles counties on the coast.

A good alloy for bearing purposes must consist of at least two constituents, namely a hard one to support the load and a soft one to act as a plastic support for the harder grains. The cheapest of the white metal alloys is lead and antimony. The eutectic mixture is composed of 87% lead and 13% antimony. As the antimony increases the alloy becomes brittle, but a slight excess gives better wear, as the hard grains of antimony are imbedded in the soft eutectic. Tin imparts the rigidity and hardness without increasing brittleness. Babbit metal is the most expensive of these alloys, consisting of 89.1% tin, 7.4% antimony, and 3.7% copper.

A conveyor of exceedingly simple type is used in the gold mills in Western Australia. It consists of a semi-circular trough about 60 ft. long, provided with a ladder-like frame, with blades hanging from the rungs, which is made to move horizontally to and fro on rollers. The blades are free to swing in one direction, but are prevented by a stop from swinging back farther than the perpendicular. When the ladder is traveling forward, each blade hangs vertically, and pushes a little heap of ore before it for a distance of 20 in., the length of the stroke. On the return stroke, the blades being free to swing, slip over the tops of the little heaps and on the completion of the stroke resume their original vertical position. To install a reciprocating conveyor 100 ft. long, capable of transporting 10 tons of ore weighing 150 lb. per cu. ft. would cost from $700 to $1200. This would require a 15-hp. motor.

Discussion.

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy.

Mill-Tests.

The Editor:

Sir—Descriptions have lately appeared in the technical press giving details of construction and apparatus of testing plants capable of treating large samples of ore. Some of these plants are in reality very complete reduction plants on a small scale, and can treat as many tons of sample, given plenty of time, as may be desired. In one of these descriptions the statement was made that small preliminary tests were made as guides for the large final test, and that the results of the large and small tests rarely differed more than 5%. I think this will be admitted to be the case in almost all testing works, and there is no question in my mind as to which test is the more nearly accurate or more nearly represents the results that will be attained in a proper mill. The larger or mill-test bears a very close resemblance to the first few days run of a new plant, during which the best results are rarely expected and never attained.

Recently a number of tests on lots of 200 lb. each have been made by Mr. Empson, preliminary to the design of a 1000-ton mill and cyanide plant at La Luz, in this State. The tests were numerous and exhaustive, covering fine-grinding, air-agitation, and concentration. Now if a mill-test were to follow these laboratory tests, it would be along the lines of the small test that gave the best result, and would add little if any to the knowledge of the ore already acquired. It may be said that the mill-test gives data as to the actual cost of crushing, but in the present case, where the mill will consist of 200 or more stamps, and, in fact, in any case where the projected plant will be much larger than the sample plant, a test in a small mill would appear to be of little use for this purpose. Perhaps an expression of opinion from those contrary-minded, with reasons for their opinions, will put me right, and be of interest to others.

MARK R. LAMB.

Guanajuato, March 8.

Drill Contest on the Rand.

The Editor:

Sir—I have read, with much interest, the article on the drilling contest at Johannesburg, as described in your issue of March 14. From the description of the mechanism of these drills, it is my opinion that the Gordon drill will not equal the Waugh stoping-drill for up-cast holes. It can certainly do better work than the Waugh drill on down-cast holes, drilling in a breast. I do not think it will do better work in vertical holes than the Waugh sinking drill. I cannot understand why the South African people do not stope their ground with up-cast holes. They may have got into this system through the inability of native labor to drill anything but a down-cast hole by hand. The entire contest was based on drilling an inclined hole in a perpendicular face, such holes as are used in breast-stoping, or running a drift. An up-east hole, or upper, is cheaper drilled, either by hand or by machine-drill, than any other type of hole, and usually can be so placed as to break ground as effectively as any other class of hole. I have tried air-hammer drills for drilling uppers, inclined holes for breast stoping or driving, and vertical holes for sinking, with the Waugh drill, the Hardsocg, and other types. They will drill uppers and straight down-holes splendidly, but they do not drill breast-holes effectively. The Gordon drill apparently does a class of work which it is impossible to accomplish successfully with any of the air-hammer drills as yet developed and placed on the market in this country.

MINE MANAGER.

Wardner, Idaho, March 3.

Snares for the Unwary.

The Editor:

Sir—In your issue of March 7, I notice your exposure of a so-called mining company, under the heading of 'Snares for the Unwary,' an exposure that I was glad to see, and hope that there is someone that is in a position and has the stamina to take action against any and all such wild-cat schemes, for they not only rob the poorer class of people who are trying to better their condition, but do legitimate mining an endless amount of harm: and I would like to see all such propositions, or rather, the men back of them, put where they belong, that is in State's prison. We brought to the attention of our last legislature the need of a law to make all such schemes a felony, and such a law was passed by both houses, but for some unexplained reason it did not become operative.

While I am writing, there is another thing that I would like to suggest, and as long as I am at the head of our corporation, it shall be the rule of this office: I believe that Congress should pass a law making it compulsory for the boards of directors of all corporations to report to the stockholders each and every month, or as often as they meet, a detailed account of the business done during the previous month. Some may say that it is too expensive to do that, but as you know, there are many inexpensive duplicating machines that will run anywhere from 100 to 2000 copies per hour at a cost of a very few cents, and they can be mailed at one cent each, and I am satisfied that there is not a stockholder anywhere that would object to the extra expense. There are many reasons that could be advanced in favor of the above suggestion, but I need only give one: I like to know what is being done with my money, and I think others are the same, and should have the same privilege.

I sincerely hope that the Industrial Investment Co. may not only be enjoined but suppressed completely, and all others of the same character.

W. C. FERRIS.

Benson, Arizona, March 10.

[We welcome this expression of opinion. Undoubtedly publicity is the best preventive of wrong financial methods.—EDITOR.]

Tube-Mill Lining.

The Editor:

Sir—In reply to the letter of Mr. C. E. Rhodes, in *The Engineering and Mining Journal*, I had written claiming the credit for the El Oro tube-mill lining for Mr. J. R. Brown, whose name until then I had not seen associated with this invention. A circular reached me from the Blaisdell Company of Los Angeles, acknowledging the origin of this plate, consequently I did not forward my contribution to the discussion in your paper.

In view of Mr. Rhodes' letter in your issue of December 21, 1907, I may possibly be pardoned for quoting this letter in part: "Tube-mills were first used at El Oro commercially on the completion of mill No. 2, about the beginning of 1905. The liners used were the chilled castings from Krupp's foundry, who supplied the mills. Subsequently liners were cast at the foundry of the El Oro company. Several innovations were tried, but it was not until about the beginning of 1906 that a sketch was delivered by Mr. Brown, who was in active charge of the tube-mills, to the mechanical department, then under my control. If I am not greatly in error, the idea of the corrugations on the plates was primarily to give the pebbles a chance of greater lift, and at the same time exposing a greater thickness to their abrasive action. I suspect, therefore, that, like so many other useful inventions, the wedging of the pebbles, forming a silex lining, was more 'by luck than by cunning'."

Mr. Rhodes is apparently not of this opinion. I give herewith a sketch of the original ribbed plate, as designed by Mr. Brown, which is very different from the amended plate as shown in the photographs. Presuming this was the case, I do not know that the consequent discovery of the wedging of the pebbles, forming a silex lining, detracts from the merit due to the originator, any more than the traditional discovery of the expansion of steam by James Watt, by an observation of the lid of the kettle, suffers discount from the fact that that gentleman did not place the identical kettle on the hob to observe the phenomena due to the generated steam. Both gentlemen profited by their observations.

Since writing the above I have noticed in the *Mining Journal*, London, in connection with the Waihi Grand Junction Co., Ltd., New Zealand, that there also a gentleman, named F. C. Brown, has invented a ribbed plate for tube-mill liners, described in the words of the chairman, as follows:

"The coarsely crushed ore passes direct into tube-mills fitted with Brown's patent hard iron-ribbed liners, and is reduced to the required state of fineness. The great economy and efficiency of mills fitted with these liners, I think, arises from the fact that the flint pebbles are lifted by the ribs and fall in a cascade, whereas in other mills the pebbles merely slip round on a smooth surface, grinding away to a great extent to waste. The first one fitted at Komata ran continuously for 18 months, having ground over 27,000 tons of intensely hard and very coarsely crushed quartz, the liners then only being partially worked away, and as since a further improvement has been made in design, it is safe to calculate the life of a liner is, at least, two years."

It would, therefore, appear (unless there is some connection) that these two gentlemen of similar name have developed along similar lines the ribbed liner. It would seem, however, in the latter case, that the part played by the pebbles in wedging themselves, forming a silex liner, has not been recognized or, at least, acknowledged.

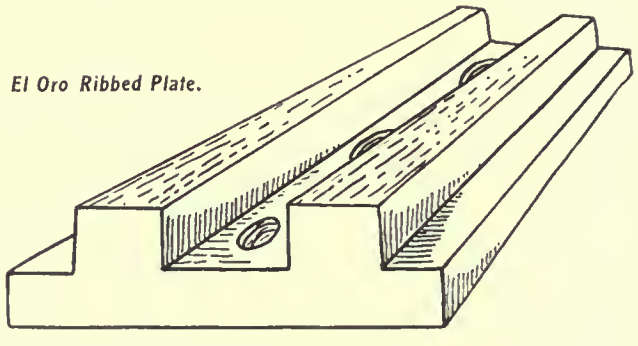
This similar evolution of the liner is not without interest, and renders plausible, if not probable, the remarks at the close of the above letter, regarding the prototype of the El Oro liner.

H. E. West.

Akmolinsk, Siberia, February 2.

The Editor:

Sir—In your issue of February 29, in an article by Mr. J. R. Brown on the ribbed form of tube-mill lining, Mr. Brown says: "Mr. Hardinge admits that his Mexican patent was issued to him under date of February 22, 1907, so we need not further pursue



El Oro Ribbed Plate.

the inventor of the conical tube-mill. * * * O. Crimmann and R. Riley obtained a Mexican patent, dated August 29, 1907. * * * If the lining really was used in Caesar's time, as Mr. Foote intimates, I give it up; but if at any later time, I claim it." Mr. Brown also says that it is his desire to sell at a small profit an "untainted lining" which mill-men may safely buy and use.

The inventor of the conical mill has not been aware of being the object of pursuit,* unless the article in your issue of December 21 (page 775) on this same subject was intended as such. In answer to the latter we must admit having written a reply, which finally found a resting place in our waste-paper basket, for which act of consideration to you and your readers, we accept their unrecorded thanks. As it is highly probable that this form of lining may in the future be of interest to users of tube-mills, and in order that Caesar and Brown may receive their due, we ask what Brown's U. S. patent has to do with Hardinge's Mexican, or his other foreign, patents covering the device?

Let us consider in chronological order, the claimants for the honors (dollars) for first prescribing a remedy or preventative* for the dyspeptic disorders to which the tube-mill is heir, as follows:

Foote claims no patent, but it is allowed that he is a philanthropic good fellow.

Hardinge first practically applied the rib form of lining to a 150-ton conical (tube) mill in January,

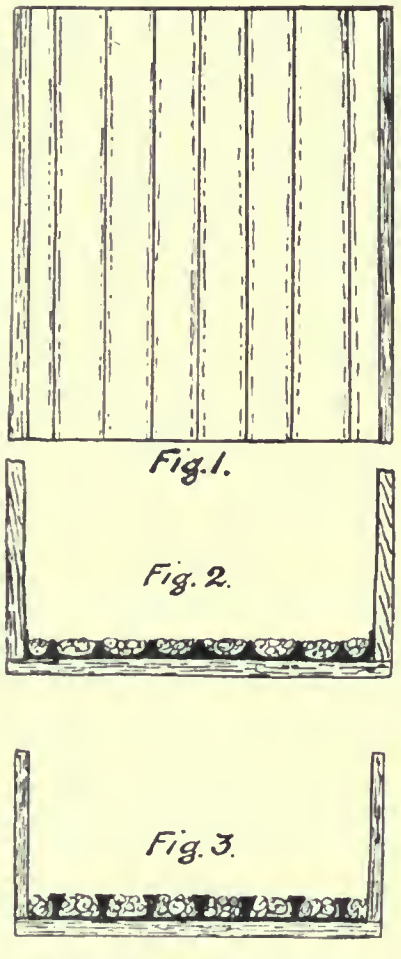
1906; he applied for U. S. patent for mill-lining long previous to June 13, 1906. The exact date is still an unpublished record in the U. S. Patent Office.

Brown applied for U. S. patent on June 13, 1906.

Riley applied for Mexican patent six months after the issuance of Hardinge's Mexican patent, covering conical mill and ribbed lining.

In this we do not wish to be understood as "pursuing" Mr. Brown, simply enjoying the parade of facts and figures from "up a tree" while dates are undergoing judicial investigation.

In an endeavor to repay the weary reader for his time, as well as affording me an opportunity to present my credentials for a perch upon the same philanthropic rail as that occupied by my co-worker,



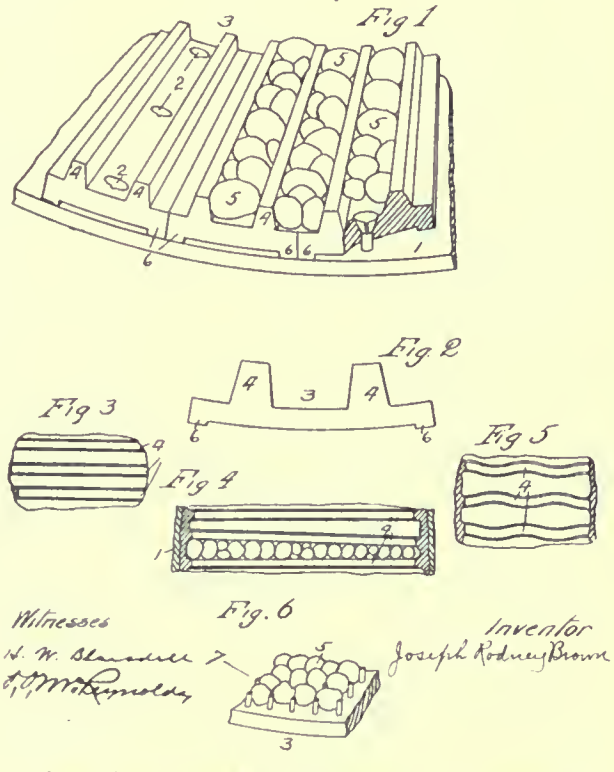
Lining for Bottom of Launders.

Mr. Foote, and not entirely malapropos to the above discussion, allow me to suggest that a satisfactory lining for launder bottoms can be made of light cast-iron plates with ribs about ¾ in. high and ¾ in. apart, spaced in staggered lengths of 3 or 4 inches as indicated in the accompanying sketch (Fig. 1 and 2), between the ribs of which the coarser sand will be retained, especially jig products, forming a lining that constantly renews itself, until the ribs themselves are worn away. This will be an order to the Public upon the El Paso Foundry to permit the use of my plans and blue-prints, from which they furnished several hundred feet of this lining in 1901—no patents applied for. The objection to the pointed form of rib shown in the sketch, is that the wearing away of the top portion gradually releases the enclosed particles, which ultimately drop out owing to want of adhesive walls. An improvement over my earlier style of launder plates is shown in Fig. 3, which, however, would be more difficult to cast and would consequently cost more.

H. W. HARDINGE.

New York, March 9.

[*Mr. Hardinge evidently thinks that 'persuit' is a correct spelling, and that Mr. Brown made a foolish error in writing 'pursue.' It is fair therefore to let the corrector be corrected. 'Preventative' is also a common error for 'preventive.' Stick to tube-mills, Mr. Hardinge, and don't bother about spelling. However, on tube-mills Mr. Hardinge goes strong, and we are glad to publish his letter, together with the note on launder-bottoms. We add a replica of the drawings accompanying the U. S. patent, No. 864,357, granted to Mr. Brown, which is interesting in view of these letters from Messrs. West and Hardinge. The pleasant controversy over this rib-lining is only another exemplification of the fact that the best proof of the value of an invention is



Lining for Grinding Mills. Patented by J. R. Brown.

the simultaneous discovery of it by several men independently.—EDITOR.]

Explosion Heard Afar.

The Editor:

Sir—It may possibly be of some interest to your readers to know that the explosion at the Judson packing-house that occurred on February 20 was not only felt, but heard, in this neighborhood, at a distance of approximately 105 miles. It was noticed at about 4:10, and was strong enough to lead some of our neighbors to believe that our magazine had blown up, the houses being shaken to some extent.

C. H. WILDMAN.

Grizzly Flats, El Dorado county, California, February 25.

VARIATIONS IN MINING COSTS.

Written for the MINING AND SCIENTIFIC PRESS
By JOHN B. HASTINGS.

Referring to Mr. Finlay's article in the PRESS of January 4, on the above subject, I should say, as suggested therein, that the engineers and managers, collectively doing the important mining business of the country, are not weak on the questions brought up, that their estimates of future operating expenses are fairly correct, and that the unwarranted assumptions as to the low costs of mining are made by men who do not analyze the subject, either from self-interest or lack of training.

Looking backward at the end of a period, the amount of money spent, less a proper construction and possible development fund to be wiped out in the future, should represent the cost of mining; however, in estimating future operating expenses of a new mine, it would be unwise for an engineer to antieipate anything except depreciation of the equipment he thinks necessary for the mine. Very often, perhaps usually, such equipment, with allowanee for usual wear and tear, will last to the end, that is, the end he can see, on whieh the mine is bought. Taking the Bunker Hill case, it would not have done to forecast an unitemized, unknown, expenditure of $3,400,000 in first estimate of working eosts. I don't know what the amount was spent for, but it should have taken care of itself; the original estimates of mining and milling instead of $3.30 per ton as they have turned out, were perhaps $6.60. The Anaeonda aeeount is probably the greatest example of a tremendous outlay for plant above any antieipated value, or its present actual one; and yet divide the life of the mine fairly into periods, and the diffcrence between the costs attained with new expenditures, and the estimated costs for the same period, based on the former going charges, probably paid for the improvements. This is the history of large suceessful mines; sueh additional improvements, besides returning their cost, usually leave appropriate balances to the good.

As Mr. Finlay thinks there is no blanket law to cover every case, the way I try to arrive at proper estimates is by taking pen and paper, beginning at the bottom and working to the top. Below are some of the problems and conclusions:

Given a mine iu northern Mexico, 50 miles from the railroad, with hard quartz vein dipping 56°, and walls that will stand indefinitely, water for milling purposes to be pumped four miles under 1050-ft. head, and an effeetive 400 hp. steam-plant eight miles away, at wood and water, the power to be transmitted to mine, mill, and pumping plant by electrieity. Mill is at mine. The ore above and below main adit as specified below.

Cost of mining. This is subdivided into two aeeounts: First, that of actual stoping, and this is all that is to be charged against the ore estimated to be in reserve above the main adit. Second, the actual development of the ore before stoping. A charge for this, for instanee, is made on the ore estimated to be in reserve for 100 ft. below the adit. As a basis of any sueh eosts it is necessary to assume a steady production, in this case, the anticipation is 55,000 tons annually, and sufficient development to place that amount in reserve as extracted. The width of the ore being only 7.5 ft., it can be mined without timbers, or such a small amount that the cost need not be predicted. I assume that small air-drills will be used in stopes, large ones in the shaft, and that levels and raises will be driven by contraet Mexican labor. To obviate excessive expense for power, stoping and hoisting must be done in the day-time. The present wage scale for Mexican miners is $1.50 per diem, the scale presented is $1.75, except in the case of machine-men who are put at $2.50 per diem, a high class (Mexican) man is needed on machines.

ESTIMATED DAILY COST OF STOPING 55,000 TONS YEARLY.

18 Miners in stopes	$ 45.00
5 Muckers and assistants in stopes	8.75
5 Trammers on levels	8.75
3 Trammers on surface, 500 ft. to mill	5.25
1 Shift-boss	3.00
Powder, fuse, and lights	15.00
½ Supplies, power, and administration	80.00
Total cost of stoping, daily	$165.75
Cost per ton (perhaps 10c. per ton too much for ore above adit)	$1.10

ESTIMATED DAILY COST OF SUPPLIES, ADMINISTRATION, AND POWER AT MINE, TO BE DIVIDED EQUALLY BETWEEN STOPING AND DEVELOPING.

3 Timbermen and carpenters	$ 7.50
1 Skip-tender	3.50
1 Powderman and storekeeper	1.75
1 Timekeeper	2.50
2 Blacksmiths	10.00
2 Helpers	4.00
1 Hoist-engineer	5.00
3 Engineers for compressor	7.50
½ Master mechanic	4.00
1 Assistant mechanic	2.50
½ Electrician	2.50
1 Foreman	6.00
Supplies, such as rails, cars, rope, drills, hose, pipe, timbers, nails, coal, lubricants, etc., at mine	35.00
1½ Engineers at power-plant	7.50
1½ Firemen	3.00
1 Yard-man	1.50
10 Cords of wood	20.00
½ Clerk	2.50
½ Book-keeper	3.00
½ Stenographer	2.00
1 Surveyor	5.00
½ Policing	4.00
½ Horses and teamster	3.00
1 Watchman	1.75
½ Management	10.00
½ General expense	5.00
Total daily costs, supplies, administration and power	$160.00
½ Apportioned to stoping	80.00
½ Apportioned to ore development	80.00

POWER PLANT.

1½ Engineers	$ 7.50
1½ Firemen	3.00
1 Yardman	1.50
15 Cords of wood	30.00
Oil, lights, and supplies	6.00

MAIN PUMPING PLANT.

1 Engineer	5.00

GENERAL OFFICE.

½ Clerk	2.50
½ Bookkeeper	3.00
½ Stenographer	2.00
½ Policing	4.00
½ Horses and teamster	3.00
½ Management	10.00
½ General expense	5.00
Total daily cost of milling and cyaniding	$256.16
Cost per ton at 55,000 tons per annum	$ 1.70

ESTIMATED DAILY COST TO PLACE IN SIGHT 55,000 TONS OF ORE YEARLY.

Sinking main shaft 321 ft. per annum, at $40 per ft.	$ 35.18
Driving 1800 ft. of levels and cross-cuts, at $6 per ft.	29.59
Nine raises, each 120 ft. high, at $9 per ft.	26.63
2 Carmen on surface (underground carmen are already included in shaft, level, and raise costs)	3.50
Explosives and lights	20.10
⅓ Supplies, power, and administration of mine	80.00
Total daily cost of development	$195.00
At 55,000 tons yearly, cost per ton	$ 1.30
Cost per ton of stoping as found above	1.10
Total cost of stoping and development, per ton	$ 2.40

ESTIMATED COST, DAILY PER TON, OF MILLING AND CYANIDING IN A PLANT TREATING 55,000 TONS ANNUALLY AT 80 MESH.

1 Head millman	$ 8.00
1 Night cyanide man	5.00
½ Electrician	2.50
½ Master mechanic	4.00
3 Engineers	12.00
3 Battery-men	15.00
3 Assistant battery-men	5.25
6 Mexicans in cyanide plant	10.50
3 Men for tube-mill	5.25
1 Assayer	5.00
1 Swamper	1.75
1 Yardman	1.75
Cyanide, 275 lb., more or less	55.00
Lime, 2700 lb., more or less	20.25
Oil and lights	4.00
General supplies and expense	18.41
Total daily expense in the mill proper	$173.66

RECAPITULATION.

Cost of mining ore developed above main adit	$ 1.10
Cost of developing ore below main adit	1.30
Cost of mining ore below main adit	1.10
Cost of milling and cyaniding	1.70

Exclusive of taxes and other office expense or management save at mine and mill.

REQUIRED HORSEPOWER.

This might decide the site chosen for the power plant and mill. The amount depends primarily on the anticipated product of the mine—placed at 55,000 tons annually. For this production the items are about as follows:

	Hp.
Self-dumping skips, holding 1.5 tons, weighing themselves one ton, and rope weighing 0.5 ton, total weight 3 tons, running balanced	75
Bucket sinking-hoist	15
Station-pump	10
40 Stamps of 1050 lb. each, or their heavier equivalent	85
10 by 20 in. crusher	25
Compressor (air for drills and sinking-pump)	75
Agitation, there will always be 300 tons of sand and slime in the mill, at 48-hr. treatment	90
Tube-mill plant	35
Blaisdell excavator	10
Pumping at mill, 150,000 gal. 200—250-ft. lift, 210 gal. per min. for 12 hr.	25
Pumping from main pumping station, 105 gal. per min. for 12 hr., about 1150 ft. lift	60
Maximum power required	505

The estimate of water from pumping station is based on a daily usage of 225,000 gal., and one-third loss, besides which the mine may supply a small amount. By not running the main hoist, and two-thirds of the compressor capacity at night, a saving of 125 hp., the power required at night would be 380 hp. By pumping from the main station, and about the mill at night, and using the excavator and crusher only at night, equal to 120 hp., the power required in day-time would be 385 hp. An auxiliary object in thus averaging the use of power is to bring the amount within the limit of an available hydro-electric power.

Are the above costs whittled down too closely?

It is neeessary for an engineer to guess at the future of a mine, whether the ore will stop at the 500-ft. level as at Bodie (described by R. Gilman Brown in the *Trans* A. I. M. E.), or go down ten times that depth, as at the North Star in Grass Valley. The desirability of investment will probably be founded on the answer to the questions: How long will the mine last? How much will the future ores pay?

Suppose the mine and plant just described cost $1,200,000. This money is worth at least 6% as soon as invested, allow this interest to begin on completion of the mill, and that, as usual, an extraordinarily good run can be made the first year. At the end of the year the account stands as follows:

$1,200,000 and 6% for first year	$1,272,000
Net profit on 55,000 tons at end of first year	450,000
Balance due on investment at end of first year	$ 822,000
$822,000 and 6% for second year	$ 871,000
Net profit on 55,000 tons at end of second year	250,000
Balance due on investment at end of second year	$ 621,000
$621,000 and 6% for third year	$ 658,000
Net profits on 55,000 tons at end of third year	250,000
Balance due on investment at end of third year	$ 408,000
$408,000 and 6% for fourth year	$ 432,000
Net profit on 55,000 tons at end of fourth year	250,000
Balance due on investment at end of fourth year	$ 182,000

So that at the end of 5 years the purchaser has received his principal and 6% interest, and owns the mine and mill, as well as the tailing dump. What will they be worth? What is he entitled to? Some people have high expectations of mining investments, they have even been led to expect them by vendors. If he should want to double his money, it would take nearly another 5 years. Is this too much profit to hope for at the end of ten years of mining, is it too much to expect of another business? The fact that the mill might be warmed up on low-grade ore for a period is omitted as unessential.

Sometimes the problem is not sufficiently solved or does not call for such close figures as above; or the method of treatment advised and costs assumed are tentative, as in the following case where the

writer wished finally to consult the best metallurgists (as he would advise in every reduction case):

Given a second mine, ten miles from a branch railroad in southern California, with plenty of water, and wood at $5 per cord, but coal and coke pretty high.

A body of ore, two-thirds oxide and one-third sulphide, the former containing say 0.3 oz. gold, 6 oz. silver, 0.5% copper, 57% silica, 17% iron, 4% sulphur, 4% alumina, 2% lead, and the latter containing 0.1 oz. gold, 2.0 oz. silver, 1.2% copper, 10% silica, 33% iron, 37% sulphur, 0.5% alumina.

The mining of this soft ore through a 'glory hole' will only cost 50c. per ton; the cost of future development is entirely unknown, as it is a case of looking for another orebody. Here the engineer must make up his mind what the prospecting value of the mine is, as an empty shell, after the ore in reserve is extracted.

As the oxide when mined breaks as fine as a concentrate, and wood (wood preferably) and oil are comparatively cheaper than coke, would it be advisable to smelt such ores in reverberatory furnaces, treating 300 tons daily? Could it be done for $4.50 per ton, including all proportionate expenses on the ground and marketing of product, but not losses or deductions? And what would the losses be? Wages, $3 to $4 per diem: freights high; lime, $5 per ton.

Take a third mine in Mexico, 50 miles from the railroad, with labor at 50c. per diem, and Mexican and American mechanics from $1 to $5 per diem.

Given a compact hard pyrite ore, 15 ft. wide, and a long shoot, with smooth hard walls, dipping 65°, a homogeneous ore easily broken, containing 35% iron, 40% sulphur, 12% silica, 5% alumina; which evidently makes about 80% straight pyrite, or 9 cu. ft. per ton, allowing imported drillers to make on contract $4.50 per eight-hour shift, this ore as developed above adits should be delivered to the mouth of the mine for $1.25 per ton, including all expenses at the mine. Timbers 15c. per linear foot, but scarce.

With the following tenor for the ore: 0.15 oz. gold, 8.6 oz. silver, 2.5% copper, and analysis as just stated, with silver at 60c. per oz., and copper at 16c. per lb., treating 300 tons daily, with an admixture of 150 tons of matte, silica, and lime, which pay their own way, the following is estimate of costs and losses:

Labor, management, and general expense	$ 300
Power; 20 cords of oak	60
Tools, repairs, chemicals, etc.	50
11% coke; 50 tons at $30	1500
Total daily costs, 450 tons	$1910
Cost per ton	$4.25
Silver. Loss in smelting	$0.15
Silver. 5% off in N. Y. on $5 left	0.25
Gold. Loss in smelting	0.10
Copper. Loss in smelting, 5 lb. at 16c (leaving 45 lb)	0.80
Copper. Cost of marketing in N. Y., 45 lb. at 2½c	1.13
Freight on 50% matte at $30 per ton from mine to N. Y., 3c. per lb. on 45 lb. copper per ton of ore	1.35
Freight. Proportionate deduction per ton of ore on 1.3% off copper matte	0.19
Total cost and loss per ton of ore	$8.22

How about these smelting costs, the losses in silver, gold, and copper, the percentage of coke, the final grade of matte, and the marketing charges, and adoption of straight pyritic smelting?

Take a fourth mine on the southern Alaskan coast, a mile from the ocean and 700 ft. above it, with mild climate. Plenty of timber and water. A nearly vertical orebody, 20 ft. wide, 150 ft. long, of magnetite, carrying chalcopyrite and pyrite, with 0.4 oz. gold, 1.0 oz. silver, 2.5% copper, 47% iron, 8% sulphur, 15% silica, 5% alumina, 5% magnesia, 2% lime. From this analysis of samples obtained by blasting holes 10 in. deep, and 2 ft. apart, in all about 30 tons, and the compact nature of the ore, it apparently only takes 7 cu. ft. to make a ton. The orebody is not sufficiently developed to warrant a statement of large tonnage, but assuming it to go a moderate depth further so that it would aggregate 55,000 tons, then the further development cost on contract would be: An adit 360 ft. long at $4320; a sill-level 150 ft. long, 20 ft. wide at $4500; three raises 10 ft. high at $500; and another connecting raise 35 ft. high, to bottom of winze present, at $500; a total with extraneous costs of $10,500; or 20c. per ton for completed development.

The itemized costs of mining 250 tons daily of such a body from above adit-level and delivery with an aerial tram, a mile long and 700-ft. fall, in connection with the development and working of other mines would be:

Two compressor engineers	$ 8.00
Blacksmith and helper	7.50
Day and night foreman	11.00
Machinist	5.00
15 Machine-men at $4.50	67.50
15 Machine-men at $3.50	52.50
6 Carmen	21.00
Powder-monkey	4.00
Powder-man and roustabout	6.00
2 Timber-men	7.50
Timber	12.50
Blacksmith coal	1.50
Powder and fuse	25.00
Candles	5.00
Lubricants	1.50
Steam-coal, 6 tons	36.00
Steel and drill-parts	10.00
Sixteen assays	4.00
Tramway and general expense	39.50
Total cost of mining	$325.00
Additional development	50.00
Total cost	$375.00
Cost per ton	$1.50

The system of mining calls for a sill-level the full length and width of the ore; one through raise for air, lowering timbers, or waste, if necessary; three raises through first ten feet of pillar left above sill-level by which the ore will be drawn off as broken, and the pillar itself afterward drawn out. A sufficient allowance is made for timber-men, timbers, etc., to meet any emergency of soft walls and occasional sorting. Machines will work two shifts and all holes be loaded and fired by powder-monkey. Machine-men would work on contract per foot of hole drilled, hiring their own runners, this is on basis of

using 3¼-in. drills; a large number of smaller drills could be used, it is a question of trial and efficiency.

The costs and losses in smelting 250 tons of this ore daily, together with 100 tons of suitable silica-lime copper ores that will pay their way and stand their proportional loss, making 350 tons daily, and producing 45% matte, with silver at 60c. per oz. and copper at 16c. per lb., is as follows:

General labor, 50 men	$200.00
Administration and general expense	100.00
Coke, 13%, 45.5 tons, at $7.50	337.50
Steaming coal, 10 tons, at $5	50.00
Tools, chemicals, and repairs	37.50
Total daily expense for 350 tons	$735.00
Direct smelting expense, per ton	$ 2.10
Silver. Loss in smelting	0.10
Silver. 5% off in N. Y. on 50c. left	0.03
Gold. Loss in smelting	0.10
Copper. Loss in smelting, 8 lb. at 16c. (leaving 42 lb.)	1.28
Copper. Cost of marketing 42 lb. at 3c	1.26
Freight on 45% matte at $5 per ton to coast points, ¼c. per lb. on 42 lb. copper, per ton of ore	0.10
Proportionate deduction per ton of ore on 1.3% off copper matte	0.19
Total costs and loss per ton of ore	$ 5.16

Depreciation on a plant of this kind would be 20c. per ton.

The fifth and last mine is again in Mexico, on the railroad, with wages from 75c. per diem upward. The ore is a solid pyrite containing 3.2 oz. silver, 0.05 oz. gold, 1.6% copper, 40% iron, 38% sulphur, 11% silica, and about 1% each of zinc, arsenic, manganese, lime, and alumina. Plenty of wood and water, and abundant hydro-electric power. Smelting daily 1000 tons of ore, with 500 tons of mixed matte, silicious, and lime ores, the latter paying their way and supplying their slag-losses; with silver at 60c. per oz. and copper at 16c. per lb.; costs and losses are estimated as follows:

Labor, 150 men, Americans and Mexicans	$ 300
Administration	75
Tools, chemicals, and repairs	100
Coke, 3%, 45 tons, at $15	675
Hot blast, 15 tons coal	75
Unforeseen expenses and alterations	200
Converting	205
Total daily costs on 1500 tons	$1630
Direct smelting expense, per ton of blister copper	$1.09
Silver. Loss in smelting	0.12
Silver. 5% off in N. Y. on the $1.80 left	0.09
Gold. Loss in smelting	0.10
Copper. Loss in smelting, 8 lb. at 16c. (24 lb. left)	1.28
N. Y. charge for refining blister copper, at $20 per ton, cost per ton of ore	0.25
Total costs and losses per ton of ore	$3.12

Must these items be added to or decreased, are some too high and others too low? It may give interest to these statements to add that four of these five problems are yet unsolved, lying dormant.

Mr. Finlay has well illustrated the difference in total costs between Cripple Creek and Tennessee. The discrepancy is, firstly, between mining scattered bodies of narrow high-grade gold ore and large bodies of low-grade copper ore; secondly, between the average output of a total mining district, an aggregation of all kinds of mines, and one essentially good one; thirdly, between results obtained under the direction of a miscellaneous mass of people and that of one of the most capable of mining engineers.

The cost of the total output of a mining district can never be applied to an individual mine, not even on the Rand or at Leadville, the two areas where work has been peculiarly confined by geological boundaries. In conclusion, I wish to sign a 'round robin' of thanks to Mr. Finlay for the table of working costs compiled by him and appearing in his valuable article.

Coal Consumption.—The records of the great Cunard Atlantic liners, the *Lusitania* and the *Mauretania*, are watched with augmented interest as time passes. It is not denied that the coal consumption is about 1000 tons every 24 hours. It may be a little less or a little more. The bunkers hold 7000 tons. How much remains in them at the end of each trip is only known by a select few. We take it for granted, however, that each ship burns 1000 tons of coal every 24 hours—that is to say, the contents of the trucks of two 50-car coal trains, one train for the day and the other for the night. As there are 25 boilers, each boiler must take 20 tons per day and the same every night. It may be assumed that, the boilers being Howdenised and the coal good, each pound of coal will make 9 lb. steam; that is to say, no less than 9000 tons of steam are made every 24 hours, or, neglecting fractions, 375 tons of steam pass per hour through the engines. As the pressure is about 200 lb. absolute, each pound of steam will occupy 2 cu. ft., which means that 1,680,000 cu. ft. of steam passes through the engines every hour. These are large quantities, but they shrink when compared with the flow of water through the condensers. That will be about 50 times the weight of the feed water, or $50 \times 9000 = 450{,}000$ tons per 24 hours, or 312 tons of water every minute, or 100,800,000 gal. per day. To realize what this means, it will suffice, perhaps, to say that the quantity would represent the water supply at 35 gal. per head per day of a city with nearly 3,000,000 inhabitants, or almost enough for the city of Paris. Turning to the furnaces, we have equally astounding figures. Allowing 20 lb. of air per pound of coal, we have 20,000 tons of air passing through the grate-bars every day. Taking the temperature of the supply at 100°, we have 14 cu. ft. air per pound, so that 26,100,000 cu. ft. air enter the furnaces every hour. A pipe 10 ft. square would pass this quantity if the speed were that of a great gale—50 miles an hour.—*The Engineer.*

Montgomery county, in North Carolina, has a gold mine, named the Iola, which produces steadily about $120,000 per annum, on a capitalization of $500,000. The stock is all held locally and is not subject to hippodroming. The mine was a bare prospect and was developed by a local prospector, who still holds the control and has built a 50-mile standard gauge railroad out of the profits.

NOTES ON RAWHIDE, NEVADA.

Being an Excerpt From the Letter of One Mine-Operator to Another.

The formation is eruptive and the three porphyries, rhyolite, dacite, and andesite, are found in the district. I think the rocks occur as flows. The most important of the three is rhyolite, next the andesite, and lastly the dacite. The dacite, without doubt, occurs in necks similar to those of Tonopah. The rocks are all altered and silicified, and probably much faulted. A more careful study than I gave the camp is neeessary to determine these features.

The important strikes are on three low hills, really one north and south ridge cut into three small hills by erosion. The first to the north is Grutt hill, the second Balloon hill, and the third Murray hill.

Grutt hill more than others shows a great shattering due to cooling from a molten mass. The contraction joints are so numerous that, when cemented by quartz, a piece of rock will have as many seams of quartz as a piece of quarter-sawed oak will have markings. This quartz was probably deposited from heated ascending silicious waters. The quartz is a chalcedony and is, I think, usually barren. Occasionally a better character of quartz is found and with it some free gold; in fact, quite a few fair free-gold specimens have been taken from Grutt hill. However, with all their talk, I cannot find that a shipment has ever been made from this wonderful hill. There is nothing that can be called a fissure, nor any body of ore that in any way approaches a vein. Such workings as the hill affords, show no definition or walls. I rather think most of the shafts have been sunk at places where a few specimens have been found; these occur always in the irregular 'seams,' as they are called. They are not 'seams,' but I know of no better word. They are narrow, as a rule, and the widest is seldom more than a half-inch wide. The ore does not even follow a zone of fracture, shear zone, brecciated zone, or crushed zone. The whole hill of some 60 or more acres is of about the same character as far as the seams go. I can account for it in no other way than that the whole hill was infinitely cracked in cooling and the little cracks cemented with silica. These seams are very numerous, but those carrying gold are not numerous enough, in my opinion, to make the whole mass even a low-grade ore.

There are probably some half dozen shafts on this hill. Most of them are the work of lessees. Their 'ore,' as they call it, is thrown over the dump like waste, and it resembles waste, regardless of the claim being made that it is all mill-ore. It is mostly altered rhyolite and shows a little iron stain. The lessees all say that they "will cross-cut at the 50-ft. level," as they left the vein at some point higher up in the shaft. Most of these leases are for sale, and one must expect a strong statement from the owners, and generally gets it. I saw some twenty or thirty sacks of ore on the hill, but no claims are made that any has ever been shipped. I am told that a few sacks running from $1000 to $3000 have been shipped. This arises from the fact that many specimens have been found on the hill.

As an example of the foundation for stories such as you are reading daily: On Grutt hill about February 1, quite a few little seams were observed. After cleaning off the surface, this strike was left for ten days, and was daily visited by hundreds, if not thousands. When it got stale as a star attraction of this kind, a few holes were placed and the mass blown out. It is said some seven sacks of $3000 each were recovered. A piece was thrown through a bank window, and was accepted for the price of the glass and put on deposit for the orphan fund. These kind of yarns, when well circulated, are largely responsible for the 3000 people that now inhabit the camp. I was not present at the great blast, but arrived the next day. I visited the hole from which this $21,000 came and found it about 6 ft. long, 3 ft. wide, and about 18 in. deep. I saw no signs of a continuation of the ore, or any ore at all in the side, ends, or bottom. This will give an idea how completely these seams can be dug out and how they lack continuity. Holes may be found within ten feet of one another, and yet no connection can be observed between one and the other.

The lessees on Grutt hill are working most indifferently—none of that snap that was found at Tonopah and Goldfield. On one lease some 20 sacks are piled, and at two other places from five to ten sacks. These have been on the ground for several months. One lessee claimed $12,000 per ton for his six sacks—but no care was taken to prevent theft! This is a sample of the 'dope' that is handed out.

Balloon hill is somewhat different, in that the mineralization seems to follow incipient fissures in the rhyolite. There is but little silicification, and pieces of much altered rhyolite, called locally 'talc,' will be found at times to run very high. In this respect this hill much resembles the Bullfrog district, much of the high-grade stuff being a marker for the ore of the Montgomery-Shoshone. The two principal leases on this hill are the Kearns No. 1 and No. 2. The No. 1 is said to have shipped 23 tons of ore to Goldfield that assayed $44.80 per ton. Some 120 tons of ore are now sacked on the dump. At the time of my visit all the material that came from the shaft went over the dump. It looked like country rock, some pieces being more silicified than others. Great claims are made for this and the No. 2 lease, but I saw no ore being sacked on either. At best they can be only fair mill propositions, in my opinion. What gives the values are the talc seams, and the gold in these is secondary and as fine as flour. It is not uncommon to see very rich hornings on any and all of the principal leases. When one knows the streaks and seams, the richest kind of rock is readily found for the visitor. Many a visitor leaves the camp with most glowing yarns of the hornings that have been made for him.

I was not permitted to sample anything, in fact, did not go that thoroughly into the camp. Prices for both mining ground and real estate were so high and the tone of the camp so uncertain, that it

did not appeal to me as a camp that would win out. In this way I may be wrong, as these desert porphyry camps have proved surprises only too frequently. The heart of the camp, say about 60 claims, is owned by three outfits—the Grutt Bros., King of Montana, and the Van Dorn's.

The only working of any consequence on Murray hill is the Murray lease, incorporated under the name of the Rawhide Mining & Reduction Co. There seems to be more of a vein here than on any of the above mentioned leases. A shaft has been sunk some 75 ft. and a few sacks of ore were to be seen on the dump. Mr. Murray told me that he had sampled 350 ft. of vein and had secured an average of $79.80 per ton in gold. Stock is to be had, I think, at 25 cents. In fact, every lease or hole in the ground is incorporated or in the process, and it is readily apparent why such statements issue. I noticed that all ore went over the dump with the usual carelessness; it is probably not very high-grade.

The Miller lease is located on Hooligan hill. The shaft is about 60 ft. deep and considerable drifting has been done. No high-grade is claimed, but I was told the whole width of country rock, called a vein, assayed 16 oz. gold. This is pretty high-grade ore to throw over the dump. This lease, I understand, is incorporated and the stock held in Chicago. There are seams that will pan well, but I am very much of the opinion that the general run is low. I saw nothing that I would call a vein. The formation at this point is, I think, a dacite and is quite strongly fissured; most of these fissures are open and in many places one can shove his hand in. The shaft has been sunk on one of these and it is called a hanging wall. I saw no silicification or even crushing along this fissure or zone, so I could hardly call it a vein. There are little oxide of iron seams that will pan very well. At a certain place on the dump good pannings are found, but whether the whole dump will do as well, I am unable to say.

Well, there are many other points of interest about the camp, but they are about like those enumerated. in fact, the ones mentioned are the best. Now, I cannot see that Rawhide has developed a great quantity of even milling ore. The obscure occurrence of the ore has made it difficult to find and more difficult to follow it. Still we have all grown to think that anything is possible in these porphyry formations, after the history of Goldfield. I think it well to keep an eye on the camp, but at present I could not recommend either mining or real estate investments. I had an eye only to the speculative side of the camp, and intended to invest only upon finding a camp of undoubted merit. I think conditions poor for promotion, and the camp did not look good enough to take a chance at their prices.

There will, in my opinion, be a great reaction from the present boom, as there are now some 4000 people in the camp and probably not more than 500 are given a living. The rest are hangers-on or prospectors and lessees. This condition cannot last, and undoubtedly the great number of unemployed left in various busted camps round about, made it possible for Rawhide to have a population today of 4000. The camp does not justify a population of more than a few hundred, as there are but 50 men working on the mines for wages. The wages are high and have attracted a great many idle miners from other camps, like Goldfield and Tonopah.

While I have not a great deal of confidence in Rawhide, I will keep an eye on the camp. If I get any really reliable information I may make another visit in there during the next month or two. At that time I expect to see prices much lower for mining ground. But it is not unlikely that by that time at least 100 mining companies will have been incorporated, and in that event it will be hard to get in on the ground.

To sum it all up: There is at present no quantity of high-grade ore opened up in the camp; this is evident, for they are not sacking and shipping, and there are at least 75 teams going back empty to the railroad and willing to haul ore for $5; there is not a true well defined vein in the camp, outside of the Royal and Tiger, some two miles west of the town. As a milling proposition, the conditions are bad because there is no water within 9 miles and no fuel within 35 miles. The camp will have to have a railroad, and to get this they must show up a large amount of ore. The little mills that are talked of now will never pay much better than shipping. It is very difficult to get any reliable information, and knowing that there is a great deal of fake handed out, one is too suspicious to believe any stranger. To sample the camp independently is unallowable, so that general impressions are all that most leave the camp with. To me there is not the right tone about things and there is too much insincerity about the whole place. But keep an eye on the place: it may have some surprises.

U. S. Geological Survey.—A report on the Park City district, Utah, is in course of preparation by J. M. Boutwell, who has recently returned to Washington from a thorough inspection of this district. Last year Mr. Boutwell had the charge of the statistical work of the Survey on the production of zinc, lead, and quicksilver in the United States; but he is now devoting his entire attention to mining geology. C. E. Siebenthal has taken up Mr. Boutwell's work in zinc and lead, and the subject of quicksilver has been assigned to W. D. McCaskey. Mr. Siebenthal is also gathering statistics of general mine products in the Mississippi Valley. By direction of the Secretary of the Interior, James H. Gardner is making a classification of the government coal lands in the Carthage district, Socorro county, New Mexico, which will be followed by their valuation and restoration to public entry. Mr. Gardner has been at work in the Carthage district nearly a month. Waldemar Lindgren left Washington on March 15 to gather geological and statistical information in California, Nevada, and Utah. Mr. Lindgren is in charge of the work of the Survey on metalliferous mineral deposits of the United States. His trip will consume about a month. The Survey investigation of the copper deposits of Shasta county, California, has recently been completed by L. C. Graton. Mr. Graton is now in Washington working on his report in this connection.

CYANIDATION OF SILVER ORE IN MEXICO.—I.

By W. A. CALDECOTT.

*The remarkable advance during the last few years in the treatment of silver ore in Mexico may be very largely attributed to the replacement of the old and costly patio process by cyanide treatment preceded by very fine crushing, to railway development and to water-power installations, which provide electric power cheaply for remote mines, where the cost of fuel would be prohibitive. Power is now being transmitted up to 170 miles, and supplied at 30 s. per horse-power per month, or considerably less than the average cost of electric power on the Rand.

The patio process, invented at Pachuca by Bartolomé de Medina in 1557, nearly a century before Van Riebeck landed at the Cape, is still in operation at the same mine in that district, but is now mainly of historical interest. The wretched condition of the mules at present employed in working it, in place of the men who used to tread the *torta*, makes its disappearance less regrettable than if animals had been replaced by the efficient mechanical digging appliances which have been invented for the purpose. The process of cyanide leaching preceded by a chloridizing roast is also now a thing of the past, and much of the same applies to hyposulphite lixiviation.

The pioneer work of our past president, Charles Butters, is indissolubly associated with the advance in Mexican cyaniding and fine-grinding practice, while the El Oro company is famous throughout the mining world for its enterprise in developing metallurgical methods. But apart from these well known names, the results of the skill and energy of our fellow-workers in charge of various ore-reduction plants are obvious in every mining district. While these last are without the great advantages of the cumulative experience and resources of the group organization, this is in some measure offset by the judicious foresight of individual companies in providing means for carrying on extensive experimental work, and also adequate plants for handling the ore under routine working conditions.

The attitude of the Mexican Government under the firm rule of that remarkable man, Porfirio Diaz, is distinctly favorable to the investment of foreign capital in mining and other industrial enterprises. It is to be regretted, however, that in spite of the many opportunities which the application of modern methods in Mexico offer, the amount of British capital now invested there is proportionately far less than was the case some eighty years ago, in the days of the United Mexican Company.[1]

Unskilled labor is cheap, costing in all about 1s. 6d. per day, but this advantage is somewhat offset by its irregularity, owing to the occurrence of the numerous church *fiestas*. The natural hereditary tendency of the Mexican laborer, or *peon*, to steal all he can, is counteracted by a regular system of special clothing for work in the extractor-houses, supplemented by watchmen and electric alarms. Shrines and bull-rings to suit the tastes of workmen appear to be almost regular items in a mining company's equipment, and some knowledge of Spanish is a necessity for those engaged in mining work. In the City of Mexico an electrolytic refinery for gold and silver bullion was started in 1906 by a private company, whose enterprise in this respect is significant. The metric system is generally used in dealing with Mexican silver ores. Thus cyanide consumption is expressed in kilograms per metric ton of 1000 kg., or 2204 lb., and silver or gold are reported in grams per metric ton. Conversion, however, is readily accomplished by taking 1 gm. per metric ton as equal to 14 grains per 2000-lb. ton, and 1 kg. per metric ton as equal to 2 lb. per 2000-lb. ton. Mexican currency is practically equivalent to one half the value of corresponding U. S. coins. Hence the *peso*, or Mexican dollar, is worth about 25 pence, or 0.5 dwt. gold.[2] The fluctuating value of silver, however, introduces a disturbing factor in mining operations with which we are happily unfamiliar here; the result of a 10% depreciation in the silver market may best be realized when the effect is considered of a possible 10% drop in the percentage recovery of gold from banket ore.

The average Mexican silver ore is usually a hard flinty quartz containing little extraneous base metal mineral.[3] The bulk of the silver exists in the form of sulphide, associated at times with a little arsenic or antimony, while occasionally silver chloride and native silver occur. A small percentage of gold is found with the silver and constitutes a considerable proportion of the bullion value, since with silver at 2s. 6d. per oz., gold is worth 34 times as much as silver. As a rule the gold is extracted during cyanide treatment a good deal more readily than the silver, so that special attention during treatment is not paid to it. Manganese is occasionally found associated with silver ore, and is reported to exercise a detrimental effect on the extraction.

The essential features of present-day treatment of silver ore in Mexico consist in very fine crushing with cyanide solution, treating the bulk of the resultant pulp as a slime by decantation, followed by mechanical filtering and zinc-shaving precipitation of the solution. While the foregoing broad statement may be taken as correct, there exists, as is naturally the case with a progressive art, a considerable diversity of opinion among competent operators as to the advisability of many details of practice, and hence the following more detailed descriptions must not be considered as universally applicable.

The fine state of division and uniform distribution of the precious metals in the ore render finer crushing necessary than in common practice on the Rand, but the means adopted for this purpose naturally vary with the existing equipment of mills and with the views of those in charge. Generally speaking, stamps followed by tube-mills represent the most advanced practice, but at a Guanajuato plant stamp-milling alone with slotted screening equivalent to a wire-woven screen of 45 mesh serves to convert the bulk of the ore into slime, though at

*Abstracted from *The Journal* of the Chemical, Metallurgical & Mining Society of South Africa, January, 1908.

[1] *The Mining World*, p. 704, Oct. 26, 1907.

[2] The legal value of the *peso* is equivalent to 0.75 gm. fine gold.

[3] Cp. Hofman's "Hydro-metallurgy of Silver," p. 286, 1907.

the cost of the low duty of 2.7 tons per stamp per 24 hours. At a Pachuca plant, stamps, followed by Chilean mills crushing through 80 mesh, are used and yield much the same resultant pulp.

The most notable and up-to-date plant, however, is the Mexico mill of the El Oro company, which has 40 stamps and six 4 by 20 ft. tube-mills to reduce with 16-mesh battery screening 200 tons of hard flinty ore per day to a product of which 90% passes 200 mesh. Taking each tube-mill as equal to 20 stamps in crushing capacity, this equipment, with five tube-mills running, virtually means a stamp-duty of about 1½ tons of ore per 24 hours. This mill, which has only lately started, should throw much light on the debated question as to whether under such conditions all-sliming yields more profit than the present usual production of 50 to 75% slime, with the balance of the pulp as specially hard and tough fine sand requiring treatment by leaching. Should it be possible in the future to secure as rapid dissolving of the metal in the sand as of that in the slime, it is probable that the next operation of separation of solution and solid in these two products will be carried out in the same way as, for example, by horizontal mechanical filters. As is realized here, the question of the actual cost of all-sliming is of great importance in view of the simplicity and other obvious attractions of the method.[4] Other points of interest at El Oro are the satisfactory use of separate iron guides instead of wooden battery guides, and of concrete mortar-blocks. Trials are now proceeding in stamp-milling without battery-screening, but with a high slot discharge on the lines of the old German schubersatz.[5] As at the Homestake in South Dakota, a foundry is run by the El Oro company, and also a small blast-furnace for periodically working up slag and other by-products, both of which prove of great service. The corrugated cast-iron tube-mill lining block is employed, and is claimed to give treble the life of plain iron liners.

Amalgamated copper plates are not generally used in Mexican reduction plants, but following the stamps, and sometimes the re-grinding appliances as well. Wilfley or other concentrators are employed to remove any metallic or granular particles of valuable mineral which would yield but a poor extraction in the sand-plant. The concentrate is usually shipped to a smelter, together with a certain amount of hand-picked rich ore.

The system of the secondary grinding circuit involving hydraulic classification of all final pulp, with which we are so familiar on the Rand, is not invariably used, and in general less attention seems to be paid to minimum water ratio in tube-milling, and to maximum practicable weight, drop, and speed of stamps than is considered advisable here.

Sand is commonly separated in vats from the pulp, leaving the battery by Butters distributors, and long sand-treatment is usual, while belt-transfer and Blaisdell excavators and aerators are likewise employed at some mills. When the fall and water available permit it, discharge of sand as well as slime residues by hydraulicking into the creek is practised, and this obvious advantage is little restricted by laws upon the fouling of streams.

In slime treatment, a notable feature is the lengthy agitation and aeration by means of ordinary stirring gear, which sometimes occupies in all 50 hours. This is rendered necessary by the slow rate of solution of the silver.[6] An ingenious system for the combined aeration and agitation of sand as well as slime, on the principle of a vertical Pohle air-lift pipe in the centre of a conical bottomed vat, 40 ft. high and 15 ft. diam., has been lately introduced at Pachuca from Australia.[7] In one or two old plants, with shallow rectangular sand-vats, converted into slime-vats, stirring and aeration are more or less imperfectly performed by means of a small pipe attached to an air-hose, which is plunged by hand below the surface of the pulp into different parts of the vat in turn.

When mechanical stirring-gear is used, settlement between the numerous decantations and agitations is not carried to completeness on account of the difficulty of starting stirring again, with the result that although as much as 10 tons of solution per ton of dry slime are decanted off for precipitation, washing is relatively imperfect, and the strong 0.1% solution frequently used in slime treatment causes a heavy mechanical loss of cyanide in the solution discharged with the residue. To reduce this loss, which may approach 2 lb. cyanide per ton of dry slime, as well as to improve the recovery of the silver and gold, mechanical filters to follow and supplement the decantation are coming into general use. The Butters[8] filter is most generally employed, though the Ridgeway,[9] Burt,[10] and others are now also being exploited. As elsewhere, clogging of filters in time with lime salts reduces their efficiency and necessitates periodical treatment of the cloths in a dilute hydrochloric acid bath.

In addition to the use of strong solution in slime treatment, a good deal of lead acetate[11] is added to the charge of slime-pulp, varying from 4 to 12 oz. per ton of dry slime. This is many times the amount of, say ½ oz. per ton, used here; and the apparent reason for the practice is discussed later in the second portion of this paper.

In precipitating practice, variations caused by differing conditions from gold-ore treatment are likewise noticeable. The strong solutions employed and the considerable weight of silver to be precipitated cause the employment of somewhat coarse zinc-shavings, for which a lead coating is not needed, as the zinc-silver couple soon formed has a high precipitating efficiency. As a rule, the extractor-boxes are placed several feet above the floor so that in cleaning up, the slime can be gravitated to a common sump which supplies the suction-hose of the filter-press pump. Simply passing through a fine screen of the zinc-box precipitate affords a product containing half its weight or more of bullion, which is briquetted by

[4] THE MINING AND SCIENTIFIC PRESS, p. 658, Nov. 23, 1907.
[5] Richards' 'Ore Dressing,' Vol. I, p. 214, 1903.

[6] Griffiths & Oldfield, and *Proc.* I. M. M., p. 418, Vol. XII, 1903; also *Trans.* A. I. M. E., pp. 279 and 660, Vol. XXXVI, 1905; also Julian & Smart's 'Cyaniding Gold and Silver Ores,' p. 79, 1907.
[7] *The Mining World*, p. 693, Oct. 26, 1907; also THE MINING AND SCIENTIFIC PRESS, p. 689, Nov. 30, 1907; also *Journal* Chem. Met. & Min. Soc. of S. Africa, p. 325, April, 1906.
[8] THE MINING AND SCIENTIFIC PRESS, June 22 and 29, 1907.
[9] Allen's 'West Australian Metallurgical Practice,' p. 176, 1906.
[10] THE MINING AND SCIENTIFIC PRESS, p. 717, Dec. 7, 1907.
[11] Patented by J. S. McArthur & C. J. Ellis in 1893.

air-pressure, after partly drying with hot air in the press or in a steam-heated pan, and is then smelted into a high-grade bullion without any acid treatment. As a plant may yield a ton of bullion in a month, a weekly clean-up is common practice, and large (No. 300) graphite crucibles or forged steel pots 1.5 in. thick are used. Furnaces using crude oil as fuel are in common use, and the El Oro company employs a neat quick-acting air-lift to lift crucibles from the furnace for pouring.

At present the total consumption of cyanide varies from 2 to 4 lb. per ton of ore, and the recovery from all sources of the silver in the ore from 70 to 90%, and of the gold appreciably more. As might be expected with very fine crushing, and heavy power and cyanide consumption, the costs are relatively high, and vary between 8 and 12 s. per ton of ore, according to local conditions.[12]

Apart from the fineness and efficiency of crushing, and the reduction of solution-value discharged with the residues, the chief directions in which future improvement may find scope are probably in reduction of time of slime-pulp agitation and aeration, the more perfect dissolving of the gold and silver with lower cyanide consumption, and their concentration in a much less bulk of solution, with corresponding reduction of the precipitation plant. These changes, if ever found practicable, would reduce power, cyanide, and precipitation costs, as well as lessen the size of plants, which at present greatly exceed in proportion those in operation on the Rand.

Life of the Kalgoorlie Mines.—With regard to the statement of Hermann Landau at the annual meeting of the Associated Northern Blocks, Ltd., that the producing mines of Kalgoorlie, so far as they could see, were approaching the end, the Premier of Western Australia has cabled to the Agent-General as follows:

"21st February, 1908.

"Government geologist reports main lode of Kalgoorlie belt may be divided into two groups, distinguishable as the Western or Boulder group and the Eastern or Associated—Lake View group. In Western group lodes are well defined quartz bodies, and they have been proved to a depth of from 1600 to 2200 ft., at which depth they carry higher value than at any point below the 1000-ft. level, and present every indication of permanence. The Eastern group consists of a belt of enrichment; contemplate a series of pipe or lenses of rich ore. These have been tested to a depth of 1700 ft., at which point there is every indication that this class of country will extend to as great a depth as the ore can be profitably mined. So far as observations have, however, at present been carried, there does not appear to be any scientific reason for believing that the mines of Kalgoorlie have by any means reached the limit of ore deposition, or that the lode will not as a whole prove productive in depth."

The statement made by Mr. Landau was criticized in the letter of our London correspondent appearing in our issue of February 15.

[12] *Trans.* A. I. M. E., p. 217, May, 1905, Vol. XXXVI.

The Prospector.

NOTICE.—Owing to the large number of specimens forwarded to this department, it has been found necessary to make a charge of 25 cents (to subscribers) for each determination, in future.

W. C. M., of Imuris, Mex., sends good white clay.

The specimens sent by W. C. F., of Atlantic, Iowa, have not been received.

P. G., of Guadalajara, Mex., sends: No. 1, altered volcanic; No. 2, syenite.

S. S. S., of Winthrop, Cal., sends crystalline limestone impregnated with pyrite.

Specimens of black tourmaline rock were received from F. M. B., of Yerington, Nevada.

A specimen of gneiss, apparently a metamorphosed dioritic rock, was received from C. H. W., of Grizzly Flats.

Black sand was received from Alleghany, Cal., consisting of magnetite and chromite. No platinum is visible.

The rocks from El Paso, Tex., sent by L. & C., are: No. 1, metamorphic rock; No. 2 and 3, chert or flint; No. 4, altered feldspathic rock; No. 5, quartzite; No. 6, hornblende-porphyrite; No. 7, a metamorphic rock.

E. M. D., of Paris, Cal., sends: No. 1, breccia, mineralized; No. 2 to 4, quartz with pyrite and pyrargyrite; No. 5, stibnite and cervantite; No. 6, earthy limonite; No. 7, altered rock with graphite; No. 8, altered rhyolite.

The rocks from Silver City, N. M., marked T. L. G., are: No. 1, rhyolite-tuff; No. 2, chert; No. 3, chalcedony; No. 4, red sandstone; No. 5, rhyolite; No 6, sandstone; No. 7, rhyolite; No. 8, chert; No. 9, sandstone colored by protoxide of iron; No. 10, meta-rhyolite.

Specimens from Outlook, Wash., marked W. M., are: No. 1, tripolite; No. 2, clay; No. 3, shale; No. 4, granite; No. 5, aplite; No. 6, shale; No. 7, pegmatite; No. 8, quartzite; No. 9, limestone with calcite vein; No. 10, shale; No. 11, sandstone; No. 12, tripolite; No. 13, tripolite; No. 14, schist; No. 15, tripolite; No. 16, chalcedony pebble.

The rocks from Villa Grove, Colo., marked F. S. C., are: No. 1, feldspar and quartz sprinkled with pyrite; No. 2, hornstone; No. 3, granite-porphyry; No. 4, feldspar-porphyry; No. 5, hornstone; No. 6, quartzite; No. 7, altered feldspar-porphyry; No. 8, orthoclase-porphyry; No. 9, quartz; No. 10, quartz with pyrite and graphite; No. 11, quartz with chalcopyrite and sphalerite; No. 12, quartz with chalcopyrite, galena, sphalerite, and tetrahedrite; No. 13, rhodochrosite; No. 14, diorite.

Silica sand is not known to occur in California, and if a sand containing 98% of silica free from iron oxides could be found, it would be a valuable discovery. This material is used for the lining of furnaces, and is shipped in some cases from Minnesota to the Pacific Coast.

PRIMARY CHALCOCITE IN CALIFORNIA.

Written for the MINING AND SCIENTIFIC PRESS
By OSCAR H. HERSHEY.

In Del Norte and Humboldt counties, California, there are copper-bearing deposits that probably contain chalcocite as a 'primary' mineral. None of them is of economic importance, but they are interesting as representatives of an unusual type of mineral deposit. They occur as many small bodies of ore (frequently rich) unsystematically distributed through large masses of serpentine. This serpentine originally consisted of peridotite and related ultrabasic rocks that were intruded into the sedimentary formations during the Cretaceous period, and had by a sort of deep-seated weathering been altered more or less completely to serpentine. In the Klamath Mountain region, the serpentine areas are in places long and narrow, like dikes, in others they spread out so as to be five to twelve miles wide. There is usually much meta-gabbro and some altered pyroxenite associated with the serpentine. Copper ores also occur in the meta-gabbro, but the peculiar type under discussion is confined to the serpentine.

The best example noted is on the Cleopatra group of claims, situated in the northern part of Del Norte county, 24 miles by an old disused wagon-road or 18 miles by cut-off trail easterly from Smith River. It is in the midst of the largest serpentine area in the Klamath region. The ore consists mainly of chalcocite associated with a black iron mineral which, so far as I could determine in the field, is magnetite. These minerals form a fine-grained aggregate embedded in serpentine. There is no quartz, little or no pyrite, and no other minerals such as are common in ordinary veins. Near the surface there has been a little alteration of the chalcocite to malachite, producing a weak stain of green color, but in general these deposits resist weathering and outcrop almost in their original condition. The portion of the serpentine in which they are embedded is usually sheared and breaks down readily under atmospheric action; but the orebodies, being hard and tough, resist shearing and hence occur as 'cores,' which weather out and form masses of float varying from a few ounces to several tons in weight. They are rather widely distributed on the Cleopatra claims, but seem best developed in a north-south belt of sheared serpentine, which is about 300 ft. wide. There is no apparent system in the distribution of them through this belt, although many cuts and short tunnels have developed a series of them at close intervals along a line several hundred feet long. However, there is nothing about their occurrence here to suggest a vein. The individual orebodies are frequently lenticular in shape, but I attribute this largely to shearing around them subsequent to their formation. All the work done here has only yielded about 20 tons of ore that, by careful sorting, has been brought up to a possible copper content of 15 or 20%. The little orebodies are not sufficiently plentiful to make it practicable to work any part of the sheared serpentine as a large low-grade concentrating proposition.

Another interesting occurrence of this kind is in Humboldt county, on the divide between Red Cap and Boise creeks. A belt of serpentine averaging several hundred yards in width and many miles long follows one of the great faults of the Klamath region. Nearly everywhere it is thoroughly sheared, and being very slippery it has given rise to large landslides. This is the case where it crosses the ridge separating Boise and Red Cap creeks. When discovered, many years ago, the dike for a distance not exceeding half a mile was found to have distributed over it many hard masses of ore varying from a few pounds to probably five tons in weight. They were broken up, the richer portions sorted out, transported many miles on mule-back, and shipped to Swansea, Wales. The operation was not profitable, but the high percentage of copper gave rise to the Red Cap copper 'excitement.' It was assumed that these masses of float were derived from a continuous vein buried under the landslides that cover the solid serpentine dike, and a number of long adits were driven into the mountain, with negative results. Even in recent years, sporadic attempts have been made to find the source of the 'boulders.' Parties now prospecting there presume that there is a more or less continuous vein of ore on the uphill side of the serpentine. My impression is that nothing of value will ever be found there; that the 'float' boulders have been derived through the weathering of small hard bodies of ore distributed unsystematically and at wide intervals through the sheared serpentine. There are no seams leading to them, nothing whatever to guide explorations underground, and searching for a sufficient number of them to make a mine would be economically futile.

The Red Cap ore has no quartz and no pyrite; the gangue is serpentine and the most abundant mineral is mainly magnetite. The chalcocite varies from almost nothing to nearly 95%. Even from the float yet remaining, sacks of ore carrying 60 to 70% copper can be collected. An interesting feature is the presence in some of the best ore of cuprite and native copper. A little of these minerals also is present on the Cleopatra ground, where I have seen beautiful specimens consisting apparently of an intimate intergrowth of native copper, cuprite, and chalcocite. There was nothing about them, so far as I could determine in the field, to suggest that the native copper and cuprite had resulted from weathering of an original sulphide.

These copper deposits are apparently related to the Catini (Italy) type described by W. H. Weed in his book entitled 'The Copper Mines of the World.' At Monte Catini the orebodies occur in a mass of olivine gabbro or of diabase, and they consist of pyrite, chalcopyrite, bornite, and chalcocite, with rare sphalerite and galena; these minerals are either disseminated through the rock or gathered into irregular and roughly spherical masses or many-armed and branching stocks. The pay-ore is confined to serpentine, which has been crushed by expansion. The type includes the Libiola and other Ligurian deposits in Italy, and occurs at Wis and Rebelj in Servia and at Minas in Cuba; it is common in Turkey. Mr. Weed thinks the ore in this type of deposit was produced by segregation at the time

of alteration of the rock to serpentine. The deposits in California differ from those of Monte Catini chiefly in the presence in them of much magnetite and the absence of pyrite and chalcopyrite.

All authorities, in making up a classification of mineral deposits, place the Catini type under the general heading of 'magmatic segregation'; but there is a difference of opinion as to whether they originated by segregation from the molten magma or were formed during the serpentinization of the rock.

Magnetite is a common constituent of the serpentines of northwestern California; in places it makes 10 to 30% of them. In the associated meta-gabbros there are undoubtedly many grains of ilmenite and magnetite that crystallized from the molten magma, and in places they are concentrated into irregular bodies of low-grade iron ore. The magnetite in the serpentine may have had a similar origin, but I rather incline to the opinion that in its present form it is the result of serpentinization. Small irregular bodies of chromite produced by segregation are common in the serpentine areas of northwestern California. Some authors would consider them the product of magmatic differentiation of the molten mass, but the chromite frequently bears such a relation to the structure of the serpentine mass as to indicate that it is the result of the process of serpentinization. The chromite orebodies have the same form as the copper deposits under discussion; there is the same structural relation between the serpentine gangue and the mineral grains. Indeed, it is my impression that at a prospect half a mile south of Adams station on the Crescent City-Grants Pass stage-road in Del Norte county, chromite takes the place of the usual magnetite as the associate of the chalcocite. There can be little doubt that the magnetite-chalcocite deposits have had the same genesis as the chromite deposits. They have resisted oxidation and there has been no leaching of copper from near the surface and deposition deeper—no secondary sulphide enrichment. The minerals were originally deposited as oxides, a metal, and a high-grade sulphide—chalcocite. There was not sufficient sulphur present to combine with the iron, but generally sufficient to make the copper into chalcocite.

The localization of these deposits is interesting. Magnetite and chromite, as already stated, are common throughout the serpentine areas; further, copper ores of other kinds are rather widely distributed in these areas; but the association of copper with the magnetite and chromite is comparatively rare. Perhaps the molten rock came in contact with and absorbed rocks containing ordinary copper deposits, thus deriving an unusual copper constituent, which was widely disseminated in certain portions of the peridotite and related basic rocks, but during serpentinization became segregated with the iron minerals. However, it remains an open question as to whether the segregation was connected with the solidification of the magma or with the subsequent serpentinization. This discussion has been based entirely on field observation; the ore is worthy of mieroscopic study.

Decisions Relating to Mining.

Specially reported for the MINING AND SCIENTIFIC PRESS.

A mineral lode in a mining district had for several years been located and abandoned by different persons. These various locators had driven an adit upon the vein, which, after the abandonment, had caved and filled with earth and rock, and was overgrown with weeds. In January, 1903, a locator placed upon this vein, near such adit, his discovery notice, but performed no work of any kind upon the claim. In March he erased the former date and placed a new date on the notice, but did not work. In May he erased the March date and placed another date on the notice. His work consisted in picking on from the foot-wall back toward the hanging wall, but he did not clear to the bottom of the tunnel; he then went up the mountain and picked down, but did not go to the top; but made a new face in the white porphyry about 12 ft. high. In a contest with a subsequent locator, this was held not to be a sufficient compliance with the statute providing that within 60 days from the time of making the discovery a shaft 10 ft. deep shall be sunk, or an open-cut, cross-cut, or tunnel, which shall cut the lode at a depth of 10 ft. below the surface shall be made, or an adit at least 10 ft. in along the lode from the point where the lode may be in any manner discovered, shall be made.

Ingemarson *v.* Coffey, (Colo.) 92 Pac. 908, Dec., '07.

The United States statutes give the miners of every mining district authority to make regulations not in conflict with any laws of the United States, or of any State or Territory, in which the district is situated. Under the regulations of mining districts in California which provide for posting two notices to establish a location, it is held that the failure to comply with such mining rules in this respect, would not work a forfeiture of title, in so much as there was nothing in the rule which made non-compliance a cause of forfeiture; that, unless the rule so provided, the failure to comply with its requirements would not work a forfeiture. This is the rule in California and Arizona. But the opposite is held in Montana and Nevada.

Yosemite Mining Co. *v.* Emerson, 28 Sup. Ct. Rep. (U. S.) 196, Jan., '08.

A miner whose duty it was to fasten a rope to certain timbers in the mine, to be hoisted to an upper level through a certain chute, was injured by reason of the faulty construction of the chute, by which one of the timbers caught upon the projecting sides of the chute and broke the rope, causing such timber to fall back and injure the miner. It was claimed that the miner could not recover because of contributory negligence in not standing clear when the timbers were hoisted. The rule applied was that contributory negligence, in its legal significance, is such an act or omission on the part of the plaintiff amounting to a want of ordinary care as, concurring or co-operating with the negligent act of the defendant is the approximate cause or occasion of the injury complained of.

Leary *v.* Anaconda Co., (Mont.) 92 Pac. 477, Nov., '07.

It was held proper, in an action by a miner for injuries by reason of timber falling back into the mine while being hoisted because of a defective chute, to prove that when the signal was given to hoist the timber through a raise, it was the general custom among miners for the man giving the signal to stand clear.

Leary *v.* Anaconda Co., (Mont.) 92 Pac. 477, Nov., '07.

In an action involving the construction of a deed conveying all the minerals and metals in certain land, it was held proper to admit the testimony of an expert as to the meaning of the word 'minerals,' and that it was proper for such expert to testify that shale was a mineral within such conveyance.

McCombs *v.* Stephens, (Ala.) 44 South. 867, Nov., '07.

MINE FIRES.

By Walter O. Snelling.

*In combating mine fires the use of carbon dioxide as a means of producing an atmosphere in which combustion cannot be sustained, has been many times suggested, and frequently tried, generally with a fair degree of success. The cost of producing carbon dioxide has been, however, a decided drawback, and the danger of producing carbon monoxide by the reduction of the carbon dioxide by heated carbon, and consequently bringing about an explosion, has also tended to prevent this method from being used.

The use of sulphur dioxide in combating mine fires has not, I believe, been previously suggested or tried, and yet the method presents such decided advantages over the use of carbon dioxide, that I now suggest the advisability of considering it as a cheap, convenient, and safe means for fighting stubborn mine fires, and I herewith present some statements to show the advantages which this method would possess.

(A) **Cost, Preparation, Etc.**—Sulphur dioxide is produced by the simple burning of brimstone on a grate of suitable kind, and of such nature as could be quickly constructed, even by inexperienced men. One ton of brimstone, costing $40, will produce 25,000 cu. ft. of gas, and allowing for all sources of loss, it is probable that sulphur dioxide can be produced for $2000 per 1,000,000 cu. ft. For carbon dioxide, produced by the action of sulphuric acid on limestone, the best estimate I have been able to figure is about $4000 per 1,000,000 cu. ft., or twice as costly as the sulphur dioxide.

(B) **Efficiency.**—Sulphur dioxide is more efficient than carbon dioxide in the putting out of fire. Neither coal nor any other combustible material can possibly burn in an atmosphere containing any considerable quantity of sulphur dioxide. Sulphur dioxide is very heavy, being almost twice as heavy as carbon dioxide (1 cu. ft. weighing 81 gm., while 1 cu. ft. of carbon dioxide weighs 46 gm.), and consequently the sulphur dioxide will penetrate into gob piles, and in every way serve as an efficient agent in finding its way into every part of the region of the mine into which it is introduced.

(C) **Safety.**—None of the dangers incident to the use of carbon dioxide are present with sulphur dioxide. No explosive lower oxides are produced, or can be produced by the reduction of sulphur dioxide. Still more important, the danger always present when using carbon dioxide, of men getting into the gas without knowing of its presence, and suffocating, is absent when sulphur dioxide is used, since its strong odor gives instant warning when but a small fraction of one per cent of the gas is present in the air.

(D) **Other Advantages.**—Any leakage of carbon dioxide from a mine can only with great difficulty be detected. Frequently, in places where this method has been applied, it is probable that millions of cubic feet of the gas has escaped through unknown fissures in the rock. Any leakage of sulphur dioxide would quickly make itself known, and the openings could accordingly be closed before more than a small portion of the gas had escaped.

Conclusion.—The extremely simple manner in which sulphur dioxide can be produced, the cheapness of the method, and the efficiency of the gas in putting out fires, would seem to make this a desirable means of combating mine fires. The safety of the method, its convenience, and its utility in showing fissures, which allow escape of gas and ingress of air, are also strong points in its favor.

*Abstract of paper read before the American Institute of Mining Engineers on February 19.

Passivity of Gold.— * * * In potassium cyanide solution, gold dissolves at the anode as a univalent ion. Passivity develops in commercial potassium cyanide solution at a small concentration, a brown color, due to paracyanogen, being noticed in the solution, but in pure potassium cyanide a much higher concentration is necessary. The presence of the sodium salt in the commercial substance is responsible for this difference and the cause of passivity appears to be the formation of an invisible protective coating of sodium aurocyanide on the anode, this salt being much less soluble than that of potassium (a fact which explains the superior efficiency of potassium cyanide over sodium cyanide for the purpose of gold extraction). A similar result is noticed in the case of nickel, which dissolves quantitatively in a solution of potassium cyanide but is rendered passive, it is now found, in the presence of sodium cyanide. The authors would extend this explanation of passivity to all known instances of the phenomenon. When, in the neighborhood of the anode, the solubility product of the ions of the protecting substance is reached (hastened in this case by the presence of more sodium ions), the protective coating is formed, rendering the anode passive.—A. Coehn and C. L. Jacobson, Zeits. Anorg. Chemie, 1907, vol. 55, p. 321-355.

Molybdenite is widely distributed, but seldom occurs in quantities that can be economically prepared for the market. It is successfully separated from the gangue by an electro-static separator to form a concentrate containing about 85% molybdenite, which has a value of about $350 per ton. This metal has remarkable effects on steel, when added as ferromolybdenum, but even better results are obtained by the use of a molybdenum-nickel alloy. Both of these are preferred to metallic molybdenum, which rapidly oxidizes if added to steel in the solid state. For forgings, shells, wire drawing, and machine steel it is especially valuable. To prepare the metal, the sulphide is powdered and placed in an open inclined crucible and heated to dull redness over a charcoal fire, the mass being frequently stirred to oxidize the sulphur. The remaining yellow powder is crude molybdic trioxide, and this is then put in a porcelain dish and leached with aqueous ammonia and crystallized ammonium molybdate prepared by evaporation. The ammonium molybdate is then ignited to form the dioxide, which is reduced with carbon in the electric furnace.

COAL ON PACIFIC COAST.

The production of coal to any large extent on the Pacific Coast is limited to the State of Washington. The output from Oregon and California has been altogether lignite or sub-bituminous coal, and the largely increased production of petroleum for fuel purposes in California has materially affected the coal-mining industry in these two States. The market in San Francisco at the close of the year presented some peculiar features. Both dealers and consumers of coal, having in mind the experience of the two previous winters, had purchased and stored during the summer all the coal which they thought would be demanded during the winter. As a result, as much business was done by the dealers in San Francisco during the summer months as is usually done in the winter. During the last three months of the year, in addition to the financial depression, there was a continued season of warm weather, with the result that no drain had been made upon the stocks stored during the summer, while constant shipments of coal from Australia and Japan were arriving to add to the already full stocks on hand.

The mining of coal in California during 1907 was limited to development work on the Stone Canyon properties in Monterey county. These properties passed into the hands of New York people during the year, and in the fall and winter construction work on a railroad about 25 miles long, from the mines to the Southern Pacific railroad at Bradley, had begun. The Mount Diablo and Corral Hollow mines were practically idle throughout the year.

In Washington during the first ten months of 1907 the coal-mining industry was in a highly satisfactory condition. During November and December, however, owing to the financial stress, the output of the mines was curtailed about 33%. The price of steam coal for the first ten months of the year averaged $4 per long ton, free on board at the mines. In the months of November and December it dropped to $3.25 per ton. Lump coal for domestic use, which was sold for the first ten months of the year at an average of $6.50 per long ton, dropped to $5.50 in November and December. These reductions in price, however, were not due entirely to the financial stress. During the summer a campaign of education had been kept up with the idea of inducing the consumers to lay in their supplies of coal during the summer and avoid the shortage of coal which had been experienced in the previous winter. Domestic consumers followed this advice and stored a liberal supply at comparatively high prices during the summer. The anticipations of a winter similar to the preceding one were not realized.

There was some complaint during the early part of the year in regard to car supply, but this was not of a serious nature. On the whole the car service was satisfactory. During the midwinter, when the Alaska trade was at its height (and this is the season when the largest coal supply is required for steamer purposes), the miners' organization succeeded in unionizing the mines owned by the Pacific Coast Co. Those of the Northwestern Improvement Co. were unionized about two years previous. The unionizing of the Pacific Coast Co. mines increased the rate of wages 20% and reduced the hours to eight at the unionized mines. The only serious labor difficulty which occurred in Washington during the year was at the mines of the Wilkeson Coal & Coke Co. at Wilkeson. These mines were closed on November 6 because of the refusal of the company to recognize the union and the stand taken by it for the same hours and the same wage scale as those in effect at the Carbon Hill Coal Co. mines at Carbondale. It is understood that the mines will resume operations on the open-shop plan.

During the first nine months of the year, owing to the unprecedented prosperity in other lines of industry, the majority of the English-speaking coal miners (who are really the only practical coal miners) entered into other pursuits, compelling the operators to use inexperienced Italian and Slav immigrants. The incompetency of this kind of mine labor has not only increased the cost of production but has also increased the liability of damage to life and property.

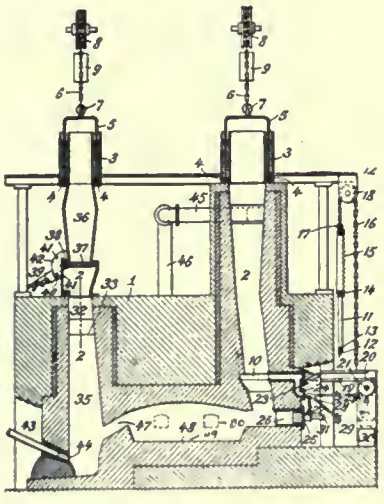
The unwatering of the 'deep lead' mines of Victoria has been useful in elucidating a number of problems connected with the raising of large quantities of water from great depths. Especially it has taught the most economical type of pumping machine. A number of types of steam-actuated pumping engines, as well as electrically operated Cornish plunger and centrifugal pumps, are in use. The result of experience indicates, without any question of doubt, that the most economical plant consists of comparatively high-speed compound or triple-expansion engines with rope drive, actuating gear-wheels, which in turn operate, through the usual connections, Cornish plunger pumps having a 10-ft. stroke, running at 10 strokes per min., the water to be elevated in stages not exceeding 300 ft. On the Loddon Valley there are four 26-in. plungers and one 22-in. The efficiency from throttle valve to water delivered is about 88%. The hydraulic gradient or angle of flow assumed by water in the pervious material filling these ancient river-beds, amounts to 8 to 10°. H. C. Hoover has pointed out that if we apply this knowledge to the subject of artesian wells it will tend to cast doubt on the theory now obtaining that artesian water often finds its source hundreds of miles away. Water may find its way to great depths from the surface because of capillary attraction and the laws governing the underground circulation of water. When it is tapped, it is impossible that the pressure causing it to rise several thousand feet to the surface can be due to hydrostatic head, because the hydraulic gradient would carry the lines of equal pressure to the surface long before they could reach the supposed outcrop.—C. S. Herzig.

Ferro-vanadium refines the grain and reduces the porosity of cast-iron as well as increasing the breaking strength. It is useful for such castings as valves and gas-engine cylinders.

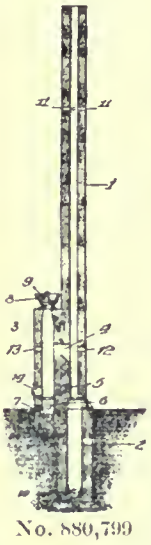
MINING AND METALLURGICAL PATENTS.

Specially Reported for the MINING AND SCIENTIFIC PRESS.

PROCESS FOR THE REDUCTION OF COPPER ORE.—No. 879,530; Louis Durand, Dumont, New Jersey.



No. 879,530



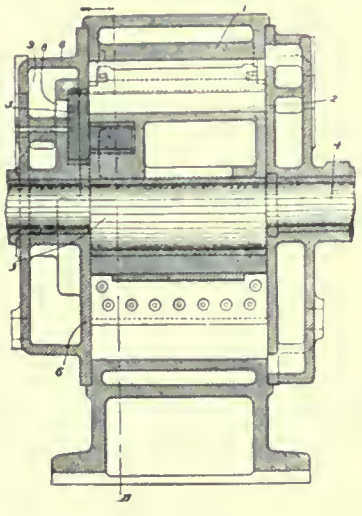
No. 880,799

The process for reducing copper ore which consists in subjecting copper sponge to the action of a reducent gas at a melting temperature, thereby melting the sponge and at the same time reducing the temperature of the gas, and utilize the gas at its reduced temperature to make more copper sponge.

METHOD OF REDUCING ORES.—No. 880,799; John T. Jones, Iron Mountain, Michigan.

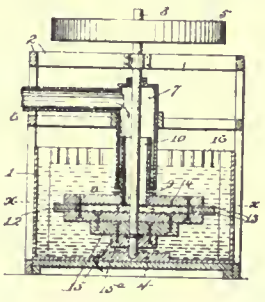
The method of reducing ore to recover the metal therefrom, which consists in mixing with the ore in finely divided condition coke, or the like, in lump form, thereby forming a column of the ore mixed throughout with such coke, or the like, to render the column interstitial, and passing through said column the hot products of combustion from carbonaceous fuel, to the exclusion of air and without smelting the ore, thereby reducing the metallic constituent of the ore to a metal state therein.

AIR-COMPRESSOR OR PUMP.—No. 879,213; William H. Tew, Glasgow, Scotland.



In an air-compressor, the combination of a stationary outer casing, an inner drum linked thereto, radial vanes operatively mounted in said outer casing and inner drum, a discharge valve or valves in said outer casing, means for imparting a rolling motion to the said inner drum, and inlet valves connected to said drum and adapted to be operated by the movement thereof.

FUME-ARRESTER.—No. 880,506; Selden I. Clawson, Salt Lake City, Utah.



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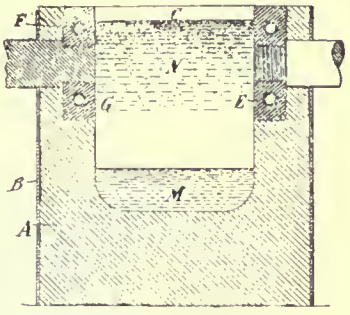


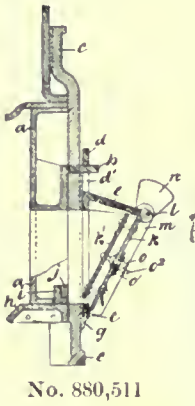
No. 880,743

In a fume-arrester, a fume-wheel having an axial fume-pipe leading into it, a ring carried by the wheel for discharging the fumes through the periphery of the wheel and forming an annular passage in the wheel from said pipe.

ELECTRIC-FURNACE PROCESS.—No. 880,743; Franz von Kukelgen and George O. Seward, Holcombs Rock, Virginia.

The method which consists in treating in an electric furnace a pyro-conducive charge by passing through it from a carbon electrode in contact with it a current sufficient to maintain the charge molten, and cooling said electrode to protect it from attack by the portion of the charge in contact with it.

FURNACE FRONT AND DOOR.—No. 880,511; Thomas Downie, Wallasey, and David Brown, Bootle, England.



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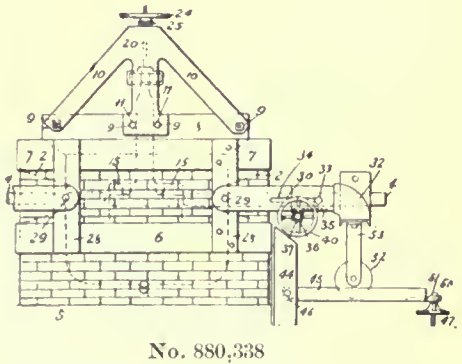


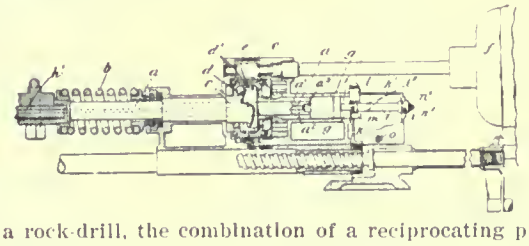
No. 880,338

In a furnace front internal protecting devices as *a*, a part thereon projecting through the front, and door frame, on the front adapted to engage with the part projecting through the front; substantially as described.

ELECTRIC-ARC FURNACE.—No. 880,338; Sidney D. Spence, Chattanooga, Tennessee.

An electric-arc furnace having a removable cover provided with openings, a fixed supporting element over said openings, a movable supporting bar, electrodes carried by said supporting bar and extending through said openings, screws connecting said supporting bar and the fixed supporting element, and connections between said screws to cause the same to turn in unison, for the purpose set forth.

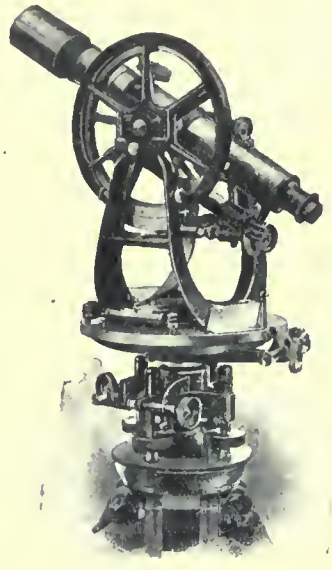
ROCK-DRILL.—No. 879,971; Bradford H. Locke, New York, New York.



In a rock-drill, the combination of a reciprocating piston, a reservoir in which air is compressed by the reciprocating piston, and means to discharge the air therefrom into the drill-hole.

A NEW THEODOLITE.

We illustrate herewith an improved theodolite recently placed on the market by Wm. Ainsworth & Sons, the well known instrument-makers, of Denver. The instrument is designated as their Type BU, and has a 10-in. 25-power telescope with 1¼-in. objective, 5-in. full vertical circle, guard, and vernier reading to one minute thirty seconds



telescope level, stadia and gradienter, 5-in. limb with verniers reading to one minute at 30° angle with telescope. The construction of the standard is such that it admits of placing a 2½-in. compass in the centre, which answers well for checking courses; most surveys now being made from a meridian established by solar observation; and for rigid-

ity and permanence of alignment the U standard is far in advance of the usual construction. All clamp and tangents are of the gib type, which when properly constructed are superior to the split clamps formerly used, in that they do not carry the instrument off the line when clamping.

The principal parts are made of the hardest bronze alloys to limit gauges, and interchangeable to the highest degree; the makers guaranteeing that any of the parts excepting

the limb, vernier plate, and centres can be interchanged with other of their instruments of the same size without throwing the instrument out of collimation to exceed fifteen seconds.

One of the advantages resulting from the use of gauges is shown by the leveling head, which cannot be cramped in any position, whereas usually when leveling an instrument it is necessary to loosen all four of the screws to prevent cramping. The cramping of the leveling head increases ten-fold the wear on the screws, and on lighter construction occasionally cramps the centres, this being the greatest objection to the four-screw or American type of leveling head.

Another of the excellent features of this instrument is the telescope construction, wherein accurate limit gauges also play an important part. The main telescope-tube is finished inside and out by lapping, as is also the outside of the draw tube, to within 0.0001 in. standard dimensions. The inside of the objective head, the outside and inside of the lens-cell, and the periphery of the objective are all of uniform diameter, true and accurate within these limits. The makers guarantee these as well as other parts of the same size instruments to interchange, with a resultant error in collimation of not to exceed the above amount.

COMMERCIAL PARAGRAPHS.

The Murray Iron Works, of Burlington, Iowa, have issued a catalogue, No. 60, describing their safety water tube boilers.

The Bristol Co., of Chicago, have published a booklet describing the varied and numerous application of recording instruments.

The American Steam Gauge & Valve Mfg. Co. has published a complete catalogue of valves, gauges, pyrometers, and other engine fittings. W. S. De Pierris & Co., 247 Pine St., San Francisco, are the local agents.

The Hendrie & Bolthoff Mfg. & Supply Co., Denver, Colo., announce that they have taken the western agency for Cameron pumps and will carry a full line of Cameron pumps in stock, and also spare parts. They also forward us their March announcement mentioning H. & B. Standard metal working crayons, Rock Island vises, triplex pumps, and so forth.

The Kilbourne & Jacobs Mfg. Co., Columbus, Ohio, is turning out a new line of dump-buckets which are being received with great favor, especially on account of their being conveniently handled. The dumping device is so arranged that they may be dumped from either side, and when righted is locked automatically. This device consists of a steel arm extending around the back of the bucket at the top edge, from bail to bail. When the bucket is righted, shoulders of the steel arm at each side are in contact with latch-bars which are firmly bolted to the bail, forming a secure latch and obviating any possibility of accidental discharge. The ends of the steel arm project so as to form operating levers. To dump the bucket the operating lever is raised at either side and both latches are completely released. This arm is so placed as to be protected from any possibility of being struck or bent, or distorted in any manner, being in continuous contact with the bucket and being placed immediately under the steel band with which the top of the bucket is re-enforced. This device solves the problem of constructing a bucket that will avoid the necessity of the operator being at only one side of the bucket, and solves it without the use of any intricate or fragile mechanism, the device being simplicity itself. The bucket is strongly constructed, being thoroughly riveted throughout, and is equipped with a false bottom of steel plate firmly riveted in place. The front, back, and bottom of the bucket are formed from one continuous sheet of steel, and the sides are stamped with a flange, through which they are riveted to the front, back, and bottom plate.

CATALOGUES RECEIVED.

The Western Electric Co. has issued a new catalogue of fan motors. The company carries a large stock of ventilating fans, which are fully described.

The Jeffrey Mfg. Co. have issued a booklet showing in numerous illustrations the diversity of uses in which their rubber belt conveying machinery can be profitably employed.

From the United States Geological Survey we have received the following advance chapters from the 'Mineral Resources of the United States' for 1906: 'The Production of Abrasive Materials,' by Douglas B. Sterrett; 'The Production of Sulphur and Pyrite,' prepared under the direction of David T. Day; 'The Production of Quicksilver,' by J. M. Boutwell; 'The Production of Lead,' by J. M. Boutwell.

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Editorial.

PROTESTS are made occasionally against attacks upon wild-cats because, forsooth, it is asserted that many a prospect, which seemed a wild-cat, has developed into a splendid mine. The classification is mistaken. A young mine, no matter how young and unpromising, is not necessarily a wild-cat, if it is an honest enterprise. It is a kitten. Let us distinguish between the domestic, useful, and well-behaved pet and the fierce feline of the wilds. There are wild-cats and wild-cats; apparently, the king beast of his kind is the puma of the frozen North.

WITH THE BREAKING of the ice in Alaska, the season for active mining is just about to open. It promises to be highly successful. News of discoveries on the Koyukuk and Susitna rivers, as well as in the Tanana region, gives fresh incentive to exploration. It is said of many regions that they have not yet been scratched, this is more nearly true of Alaska than any other, for there the mantle of moss and ice cover the rock surface so as to require unusual persistence in prospecting. But the development of the territory is progressing rapidly, and Seward's purchase is proving one of the most fortunate transactions of history.

NOT MANY days ago Mr. Edgar Newhouse, chief advisory metallurgist to the Guggenheims, refused to meet Mr. Thomas W. Lawson at a meeting of directors of a copper company. Not long ago Lawson was regarded at 71 Broadway as a charlatan. Today he leads the circus parade. We do not wonder that Daniel Guggenheim escaped to Europe. When we contrast the reputation of the family twenty years ago in Colorado with their latest performance, we conclude that some people are more smart than wise. Evidently Mr. Lawson is to be their financial guide, instead of Mr. John Hays Hammond. We congratulate Mr. Hammond on having no responsibility for the latest departure of the smelter people. Even appendicitis is preferable to lawsonitis.

FINANCIAL CONDITIONS must have improved greatly to warrant the flotation of the two large mining companies recently advertised in the daily papers. As the promoters of these undertakings are shrewd men, well qualified to judge the condition of the money market, we accept the inference with pleasure. We discuss the Lawson-Guggenheim spoofery elsewhere, and further criticism will be submitted next week. The second important flotation is that of the Miami Copper Company, the stock of which is offered by the General Development Company of New York. The general character of the announce-

ment made by the promoters of this enterprise is as creditable as the Lawson affair is disgraceful. The capitalization of the Miami Copper Company appears reasonable when compared to the statement of ore reserves, production, and profit. One feature of the flotation is especially commendable, and that is the willingness of the vendor company to show all the contracts involved in the purchase and promotion, these documents being placed on file in a bank that is designated. The directors are men of the highest standing and one or two of them are more than that: they are men of unquestioned honor. The prospectus as advertised is couched in dignified terms and gives the essential information in a straightforward way. It is a striking contrast to the alarums and tom-toms of Lawson.

PROFESSIONAL MEN everywhere will congratulate Mr. Bulkley Wells on his merciful escape from assassination. He has been fearless in his fight for law and order in Colorado, and has risked his life repeatedly in the efforts to crush anarchy. The attempt to kill him with dynamite occurred in the very house in which Arthur L. Collins was murdered, by members of the same association. That crime has never been expiated by the punishment of the perpetrator, and Colorado stands disgraced until justice is done.

APPARENTLY the up-to-date promoter thinks the Hearst papers well suited to getting the kind of publicity required for mining schemes, for both Lawson and Lewisohn have used large spaces in the daily papers controlled by W. R. Hearst. This means that Hearst reaches the kind of people whose money is easiest separated from them, for transfer to the *haute juiverie* of New York. That financiers and business men who used to foam at the mouth when either Lawson or Hearst was mentioned, should now be willing to do their business through such mediums, is proof sufficient of their eagerness to make money, somehow, anyhow.

Concerning Rawhide.

ANATHEMA is not argument, but it has the merit of brevity. Some of our strictures on the queer doings that masquerade as mining have annoyed the people who have such a sacred regard for truth that they do not use it. Thus, by reason of reference to the silly exaggerations that have been freely employed in the stock-selling schemes of the Rawhide boosters, we have become charged with the intention to depreciate that new gold mining district wantonly and of malice aforethought. To our critics the exposure of wrong is regrettable because it hurts business. We do not share this point of view. To us all forms of dishonesty and clap-trap are hurtful to mining; we do not regard the Nat C. Goodwins, Larry Sullivans, and Industrial Development companies and the like of them as anything but leeches that sap the vitality of a grand old industry, and we hold that any mining district advertised by such people and such methods is hindered in its successful development. The rubbish printed by the local press has discouraged investors in the East: naturally sensible people ask why leasing companies with $400 ore sell stock instead of shipping ore. The iteration of sensational news will not make a mine. You cannot turn $12 ore into $400 ore by labeling it. Stuff that will not pan a color is not rendered profitable by a bogus assay certificate. A knife-blade stringer is an uncertain foundation for boisterous finance. Luckily there is rich ore at Rawhide and some of it is very rich, but even the real discoveries are doubted amid the atmosphere of mendacity deemed essential to a boom. Besides the one or two discoveries of rich ore, such as the Kearns leases, there are several wide lodes of fair ore that will require treatment on the ground in order to be profitable. This will come, but not with shouting. Intelligent development, followed in due course by the erection of mills, suited to the ore, will make Rawhide a productive district. No one will be more glad to record such industrial progress than this journal: no paper has greater contempt for the aero-thermal aspects of stock-jobbery than the MINING AND SCIENTIFIC PRESS.

The Clown and the Hippodrome.

THE hippodrome is Wall Street: the clown is Thomas W. Lawson; among the other performers are professional men of the highest standing; the on-lookers that throw their pennies into the four-ringed circus are the horde of simple greedy people, who accept the antics of the clown as finance, who rate the financial acrobats as philanthropists, who expect to get $10 for $5, and mistake the performance of a circus for the business of mining. Of all the impudent assaults on the credulity of the public, the prospectus of the Yukon Gold Company is the least excusable. Like an overture to a ballet, Lawson had previously issued several flaring notices hinting and promising something splendid in the way of a get-rich-quick scheme and we had read them as we read the advertisements of pink pills for pale people, for such stuff throws side-lights on human folly. We began to wonder what new imposition Lawson was going to foist on the public—the very public whom in a magazine article he recently flouted as "saffron-blooded apes" and "gelatine-spined shrimps," because they had proved unwilling to accept him as a reformer, having found out that he was an impudent scoundrel. But the wildest guess would never have imagined that the Guggenheims and all their cohorts of technical talent would be playing the harlequin to this clown of many stock exchange circuses. We would as soon have expected Phelps, Dodge & Co. or Lee, Higginson & Co. to enlist the services of Jack London or Carry Nation in disposing of the Copper Queen or the Calumet & Hecla. Not that the Yukon placers are comparable for a moment with the two enterprises mentioned. We say frankly that in San Francisco, where information concerning mining in Alaska is not wholly wanting, it has been supposed by those unfriendly to the Guggenheims that their Dawson investment was a rank failure, while those who are without prejudice have inferred, from reliable news, that at

best it was yet a doubtful venture. Whatever doubts existed are not removed by the statements quoted in the flamboyant prospectus of Lawson.

That prospectus probably garbles the reports and at best gives only fragments of the complete statements submitted by the engineers. Until we have seen the complete reports of Messrs. A. C. Beatty and O. B. Perry we shall withhold criticism, in the interest of the profession. It will be time enough next week to offer a critical analysis of the estimates. At the present writing we desire simply to express disgust at the prostitution of the mining business by such a fellow as Lawson. He shamed the cause of reform in America; he now makes mining ridiculous. Lawson offers a number of statements, unsupported even by the fragmentary quotations from the engineers' reports. In his latest advertisement he says that the "actual worth" of the stock is $15, that is, on a capital of 3,500,000 shares, the mines are worth $52,500,000, while the estimate given in his own prospectus is that $36,000,000 of profit will be forthcoming in 15 years, on which basis the present worth, allowing for interest (at the rate of 10%, the minimum for a gold mine) on capital, is less than $15,000,000. A small boy's arithmetic is all that is needed to demonstrate the absurdity of Lawson's wild assertions. Our readers do not need to be told that a placer mine is not like a vein mine; the latter has possibilities in depth, miracles may happen, and even the hungriest looking prospect may be the top of a great bonanza; such things have happened, although no sane man would base any estimate on such a doctrine of improbability. On the other hand, a deposit of gold-bearing gravel is limited in every dimension; it can be measured, and any unforeseen developments are usually of the wrong kind, that is, the total profits are much more likely to fall short of, than to exceed, sanguine anticipations. In this case, on the most reasonable of Lawson's many statements, the speculator pays one dollar on the expectation that if all goes well he will get a return of one dollar, and if any estimate is incorrect he will get less than one dollar, and meanwhile his dollar will be used by the philanthropist who invited him into the game. But, the reader will say, that is not the idea of such a flotation. The man who buys for one dollar expects to sell to someone else for two or three dollars; the intrinsic merits do not count; of course, there must be reports and so forth, but as long as well known men are directors and strong backing is forthcoming, the issue will be a success and there will be plenty of people to join in a stampede for the shares. So the speculator gambles on being able to unload upon someone more reckless and more greedy than himself; he plays the game for Lawson, he joins the Guggenheim people in the hippodrome, and finally some miserable simpletons hold the bag.

The mines are said to be rich, they are said to be fully equipped (which is not correct), they are said to be owned by people of high standing and enormous financial power. So says Lawson. Why then do they want to sell the stock? People owning good mines usually offer shares for sale because they have neither the money necessary for development nor the funds to build a mill or a smelter. It takes money to make even a good mine profitable. Hence the issue of stock in legitimate enterprises. But in this case the conditions are different. Lawson says that the Guggenheim group controls companies paying "enormous annual dividends," they have been "liberal and far-sighted in their expenditures for plant," and the mines are "thoroughly equipped." Why then the need of issuing stock to the public? Why, bless you, it is done out of sheer goodness of heart and thoughtful philanthropy. Anyone might have guessed that. Lawson makes it certain. He says that "leading bankers have sought to secure the whole or a portion of the Yukon stocks," but the Guggenheims would not part with their property. Was it because if they sold to the bankers they would get less than the money they had already expended, while on the contrary they could get their money and a handsome increment besides by disposing of stock to the public? No, Sir; they were anxious to give the widows and orphans a chance. Lawson says that "the group have been convinced that just at this time, when the people are filled with distrust of all things, it will be of inestimable value to the whole investment and corporation structure to spread through the land into the hands of thousands of small investors a fraction of the stock of their enterprise at less than one-half of its actual worth." Which means that to restore financial confidence throughout the country the Guggenheims are so patriotic as to give away a dollar for fifty cents. This is extremely probable. Next Lawson says that "the money lost to the group by selling" this stock "will be many times more than made up by the increase in value of the stocks of the other corporations in the group." *Credat Judaeus Apella.* In plain English, this is all preposterous flapdoodle. As for Lawson's part in the game, we surmise that he has an option on the 700,000 shares at about $4; the Guggenheims want money badly; Lawson wants money and notoriety; they will share the spoil. If this campaign of advertisement and buncombe succeeds, Lawson promises to startle the world shortly with a $60,000,000 scheme that will be a wonder. We venture to anticipate that it will be the Consolidated Copper Co. or Copper Mines Co., as last christened, a group that will include the Nevada Consolidated and the Utah Copper, which are two great copper mines, together with the Cumberland & Ely, which is a fairly good mine, and a number of smaller nearly worthless properties, and out of this watered stock Lawson and his harlequins will make golden wine, that is, if a miracle can be performed more than once. But what need is there to say more, has not Lawson described the whole performance in saying that "this story will be unique, inasmuch as it will be the first time in the history of stocks where a story relating to a security of great worth will read like the yarns usually spun in glaring advertisements by irresponsible wild-cat stock promoting swindlers." His glaring advertisement does indeed read like the yarn of an irresponsible wild-cat stock promoting swindler. It is.

Personal.

JAMES W. NEILL is at Butte.

F. H. MASON is at Paso Robles Hot Springs.

F. M. TAYLOR has returned to Denver from Goldfield.

H. W. TURNER is examining the Monterey coal mines.

FRANK KLEPETKO is on his way from New York to Peru.

W. S. MORSE and EUGENE B. BRADEN were at Goldfield last week.

F. D. BRADLEY is manager of a mine at Seven Troughs, Nevada.

C. HENRY THOMPSON has reurned from Mexico to Los Angeles.

E. M. HAMILTON is going from Salvador to England at the end of April.

W. H. WEED is examining the San Cayetano mine, at Guanajuato, Mexico.

F. L. MORRIS has gone to Dawson, on the Yukon, to be absent three months.

W. F. FERRIER, now residing at Montpelier, Idaho, was in San Francisco this week.

J. C. PRYOR is now metallurgist to the Montreal Reduction & Smelting Co., in Canada.

H. R. PLATE is president of the University Club at Ely, Nevada, which has 100 members.

THOS. R. BARBOUR is managing director for the Balaklala Copper Co. and is now at Redding, California.

J. H. BAKER is now stationed at Madera, California, where he is engaged in examining the copper belt.

HENRY C. CARR and JOS. G. HIBBS have formed a partnership, with offices in the Penn Mutual Bdg., Philadelphia.

E. D. MCDERMOTT, after a year's residence in Spain, has returned to Mexico. He is now on his way to Guanajuato.

EDMUND A. PRENTIS, Jr., recently in Peru, is now manager of the San Carlos-Providencia mine, at Taviche, in Oaxaca, Mexico.

HORACE V. WINCHELL fell down a winze and sprained his ankle at Goldfield, where he perforce remains for a couple of weeks.

I. F. LAUCKS and M. J. FALKENBURG have opened a general assaying and mining engineering office at 609 Opera Place, Seattle.

W. M. CAHOONE, formerly mine surveyor at the Bunker Hill & Sullivan mine, in Idaho, is now attending classes at Columbia University.

J. C. DUFRESNE has severed his connection with the Canadian Metal Co., on the completion of their new concentrator at Riondel, B. C.

R. B. HEGARDT, local manager of the Old Dominion Copper Co., has returned to Globe from a brief examination of the California copper belt.

JESSE J. MACDONALD has been appointed manager of the Engineering Department of the American Trading Co., with offices at 6-8 Critched Friars, London.

JAMES C. BENNETT has terminated his engagement with the Risdon Iron Works, San Francisco. He has been in charge of the department of concentrating and smelting machinery.

WILLIAM GOWLAND, professor of metallurgy in the Royal School of Mines, has been elected a Fellow of the Royal Society. Professor Gowland has been president of the Institution of Mining & Metallurgy during the past year.

HUGH ROSE has resigned as assistant general superintendent for the American Smelters Securities Co., to take charge in Mexico as general superintendent for the Guanajuato Development Co. and its allied interests, the Pinguico Mines Co., the Peregrina Mining & Milling Co., the Mexican Milling & Transportation Co., etc. Mr. Rose will have headquarters at Guanajuato, and an office at 40 Wall St., New York.

Latest Market Reports.

LOCAL METAL PRICES—Apr. 2.

Antimony	12@16c	Quicksilver (flask)	$45@45.50
Casting Copper	14¼@15¼c	Spelter	6½@ 7¼c
Pig Lead	4.35@ 5.30c	Tin	32½@34c

ANGLO-AMERICAN SHARES.
Cabled from London.

	Mar. 26. £. s. d.	Apr. 2. £. s. d.
Camp Bird	0 13 1½	0 14 0
El Oro	1 2 6	1 2 6
Esperanza	1 4 4½	1 6 3
Dolores	1 5 0	1 5 0
Oroville Dredging	0 11 6	0 12 0
Stratton's Independence	0 3 3	0 3 3
Tomboy	1 8 9	1 8 9

(By courtesy of W. P. Bonbright & Co., 24 Broad St., New York.)

MINING STOCK QUOTATIONS—NEW YORK.

	Closing prices. Mar. 26.	Apr. 2.
Bingham Central	½	½
Boston Copper	15	12⅛
Cumberland Ely	7½	8⅜
El Rayo	1⅝	1⅝
Giroux Con.	3⅞	4
Guanajuato Con	....	2
Nevada Con	13⅛	11⅛
Nipissing	7	6⅛
Tennessee Copper	38¼	42⅛
United Copper	4¾	5¼
Utah Copper	33½	29¼

(By courtesy of Hayden, Stone & Co., 25 Broad St., New York.)

METAL PRICES.
By wire from New York.
Average daily prices in cents per pound.

Date	Electrolytic Copper	Lead	Spelter	Silver
Mar. 27	13.12	3.95	4.68	55¼
" 28	13.12	3.95	4.68	55⅛
" 29	Sunday.	No market.		
" 30	13.12	3.95	4.68	55⅜
" 31	13.06	3.95	4.68	55⅜
Apr. 1	13.00	3.95	4.68	55¼
" 2	13.00	3.95	4.68	55⅛

SOUTHERN NEVADA STOCKS.
San Francisco, Apr. 2.

Atlanta	$ 24	Manhattan Con	16
Belmont	1.15	Midway	55
Columbia Mtn	23	Mizpah Extension	05
Combination Fraction	71	Mohawk	.....
Daisy	1.40	Montana Tonopah	1.77½
Fairview Eagle	50	Nevada Hills	2 80
Florence	4.45	Rawhide Queen	2.00
Gold Bar (Bullfrog)	16	Red Top	.....
Goldfield Con	5.50	Sandstorm	37
Gold Kewanas	86	Silver Pick	24
Great Bend	42	St. Ives	29
Jim Butler	30	Tonopah Extension	78
Jumbo	.....	Tonopah of Nevada	7.75
Jumbo Extension	33	Tramp Con	20
Laguna	95	West End	2

(By courtesy of W. C. Ralston, 353 Bush St.)

COPPER SHARES—BOSTON.

	Closing prices. Apr. 2.		Closing prices. Apr. 2.
Adventure	1½	Michigan	11
Ahmeek	56	Mohawk	49
Allouez	24½	Nevada Con	11⅜
Amalgamated	58⅛	North Butte	54
Arcadian	3½	Old Dominion	36½
Atlantic	9	Osceola	80
Bingham Con	.....	Parrot	18
Boston Con	12⅜	Phœnix	50
Butte Coalition	20⅜	Quincy	83
Calumet & Arizona	100	Rhode Island	3
Calumet & Hecla	620	Santa Fe	1¾
Centennial	20½	Shannon	11⅜
Con. Mercur	36	Superior & Pittsburg	12½
Copper Range	65⅜	Tamarack	80
Daly-West	8½	Trinity	14
Franklin	7½	United Copper com	6
Granby	90	Utah Copper	.....
Greene-Cananea, ctf	8¾	Victoria	2⅞
Isle Royale	18	Winona	5
Mass	.....	Wolverine	125

DIVIDEND.

On April 4 the Bunker Hill & Sullivan Mining & Concentrating Co. will pay dividend No. 127 of $75,000. This makes the amount of dividends paid since January 1, $225,000, and the total to date $10,071,000.

General Mining News.

ALASKA.

The strike situation at Douglas Island is serious. Eight hundred miners are now on strike, and troops have been sent from Fort Edward, Haines, Alaska, to preserve order. The troops have brought a gatling gun, as it is feared that serious disturbances may occur.

ARIZONA.

COCHISE COUNTY.

At a recent meeting of the Globe Con. Copper Co. held recently the financial position of the company was published. The cost of opening the Gem shaft was $246,257, while the expense of opening the Boston mine was $110,418. The company is capitalized for $1,500,000, and there is $500,000 of unissued stock in the treasury.——The Big O'Brien mill is operating steadily, making regular shipments of bullion and concentrates.

GILA COUNTY.

Deeds have been filed recently conveying to the Miami Copper Co. about 300 acres in the Globe district, situated about 6 miles west of the town. Part of this property was formerly known as the Oates-Newman group of claims. The first unit of the reduction works of 1000 tons capacity will be constructed at once.

YAVAPAI COUNTY.

A rich discovery is reported from the Turkey Creek district. J. Condor has found a 3-ft. vein, one foot of which is said to contain over 800 oz. silver per ton.——Recent developments on the properties of the Turnbull Development have shown some sulphide orebodies similar to those of the Old Dominion. One vein is said to be 10 ft. wide and to be of good ore, carrying 10% copper, with some gold and silver. This has been found in an old shaft, and an adit is now being driven to reach this and cross-cut the vein. The adit is now 400 ft. in length, and it should reach the vein within six weeks.

CALIFORNIA.

BUTTE COUNTY.

A contract has been let by the Butte Creek Con. Gold Dredging Co., which controls 1400 acres of land on Butte creek, for the construction of a $110,000 steel dredge. The contract was let to Edward L. Smith of New York. The dredge will be the largest in Butte county. It will be equipped with forty 11-cu. ft. steel buckets. It will be a floating dredge of the single-lift type. The sluice-boxes and gold-plates will be carried on an auxiliary boat. The boat is to be built especially to handle boulders, and the buckets will bring up boulders that will go through a hole four feet square.

CALAVERAS COUNTY.

Work will shortly be resumed at the Boston mine, under a working bond. The mine has been worked to a depth of 1000 ft., and is conveniently situated. It is equipped with a hoist and mill, water being obtained from the Mokelumne canal under a head of 800 feet.

EL DORADO COUNTY.

At the Alpine mine, the vein which was previously worked down to the 200-ft. level was recently encountered in the drift on the 300-ft. level. A cross-cut has been driven 18 ft. and is still in ore, which is mineralized throughout.——At the Searchlight mine, adjoining the Goldfield on the east, two shafts have been sunk to a depth of 16 ft., about 40 ft. apart, on a 2-ft. vein of quartz. Some good ore has been developed, and the prospect has been bonded. S. Beers of the Standard Unit mine will install a mill of his own design on the Wagner mine in Bear Creek district.——At the Little Chief mine a gasoline engine will be installed to operate the pump in the new shaft.

MARIPOSA COUNTY.

One of the richest discoveries in recent years was made last week in the White Gulch district in Mariposa county, about 4½ miles from Bagby, a station on the Yosemite Valley railroad. About two years ago H. Pearson, a prospector, located the Little Gem claim, in this district, but up to a few weeks ago he had never done much work. Returning to it about a month ago, he started work, and during the last four days he extracted $3000 and uncovered five well defined veins at a depth of 2 to 4 ft. which appear to be as good, if not better than his original pay-streak. The two principal veins on the Little Gem were uncovered at a depth of six feet, and were ½ in. and 1¼ in. in width, respectively, the former averaging two-thirds gold while the wider vein contained about 30% gold. Prospecting has shown many seams honey-combing the rock adjacent to this discovery. Most of the ground adjacent to the Little Gem has been staked, but owing to the extreme roughness of the country, the work of location has been difficult. The ground is strewn with quartz float for a radius of a mile and it is being actively prospected.

NEVADA COUNTY.

The gravel recently encountered in the Posey mine is proving extensive. From the raise a cross-cut has been driven 65 ft. without encountering the rim rock, and all the ground traversed carries a considerable quantity of gold.——It is reported that the Mountain Maid mine will soon be sold and developed systematically. The old workings are shallow.——A large body of quartz is being developed in the Chicago Park district by the Golden State Mining & Development Co. Two tunnels have been driven near the crest of Pine Grove hill. A cross-cut tunnel is now being driven 250 ft. below the old workings. The adit is now about 150 ft. long, and there is about 150 to 200 ft. to drive to cut the vein, which dips at about 30 to 35° toward the adit. Winzes were sunk to depths of 20 to 30 ft. in the upper levels, but sinking had to be abandoned owing to water. It was then decided to drive the lower adit.——Developments on the Mason ranch have opened a vein which is said to assay from $22.50 to $50 per ton. The vein has been developed for a length of 22 ft. and this new district is promising.

In the Bradshaw Mts., Arizona.

PLACER COUNTY.

At the executive committee meeting of the Anti-Debris Commission recently held in Sacramento, the dams around Dutch Flat were declared insufficient.——Three lessees are working on the Big Dipper channel.——An adit will soon be started from First Brushy canyon to open up the Slope, Wasson, and Blackhawk claims. A few men are at work cleaning out and re-timbering the adit at the Red Star on Devil's canyon. Work is progressing steadily at the Home Ticket, under R. L. Fletcher.——The El Dorado, which is nearly at right-angles to the Home Ticket, is turning out considerable profits, which repay the expense of finding it.

PLUMAS COUNTY.

Development work at the Arcadia mine continues to show ore, and the drift is 40 ft. long, on a shoot of good milling grade. It is probable that a deeper adit will soon be started,

opening the vein 300 ft. lower than the old workings.——Work has been resumed on the Lone Star mine by T. Treleaven.

Two shafts will be sunk to prospect for diamonds on the Cherokee property, owned by the United States Diamond Mining Co. Two diamonds were recently found in an eclogite similar to that at the Kimberley mines.

SAN BERNARDINO COUNTY.

(Special Correspondence).—Finds of valuable ore continue in the claims that are being worked, and last week the men working in the Sloan lease on Jumbo ran into high-grade ore at a depth of about 35 ft. An assay has not yet been made, but the pannings from the bottom of the shaft give about $250 per ton. Many of the claims are in ore, and prospects on claims to the west and north of the main range have resulted in good surface indications. Hart and Hitt's Foothill and Foothill No. 1 showed good pannings, averaging from $5 to $50 for a distance of 200 ft., while the Gray Horse claim, owned by Jennings and Goodwin, showed high-grade ore on the surface. The Ross and Blackburn lease has developed some more rich ore. There was a meeting of the Business Men's League of Hart held at Norton's hotel Saturday evening, at which all of the representative owners, lessees, and operators were present to discuss the conditions of the camp and the action of the several committees. H. S. McCallum, president of the league, who has been busy with the affairs of the camp in Los Angeles, made a lengthy report which created an impression. The Salt Lake railroad will aid in the establishment of an automobile stage line from Leestalk to Hart, making the rate equal to that of the Santa Fe, which runs closer to the camp. A siding will be built at Hitt, on the Santa Fe, four miles from Hart, and a freight-house erected at once. The commissioners of San Bernardino county have appropriated $1000 for a road from this station to the camp, which has already been surveyed, and upon which work will begin at once. Better time and connections are also promised.——On the Big Chief property the 500-ft. adit was started last week, and will pierce the mountain from west to east, cutting three known veins at depths varying from 350 to 500 ft. The shaft is down 25 ft. and continues to show high-grade ore. On Oro No. 1, Hart and Hitt are driving their 350-ft. adit which is expected to cut four veins, the last at about 150 ft. depth. Hall, superintendent of the Quartette Mining Co. of Searchlight which recently bought the Jumbo group, is in Hart with a shipment of timber and tools for the main shaft, which is being sunk with three shifts, in good ore all the way. Ore from this mine will probably be shipped to the Searchlight mills within a few days.——Twin Peaks continues to develop new finds, and in what was thought to be the foot-wall some high-grade ore was found last week. The double compartment shaft in this claim is down 40 ft. and cuts milling ore all the way.——The Todhunter lessees are still driving, and will raise for the shaft after going about 25 ft. more.——On the Stampher lease, Piute Belle, the shaft is down 50 ft. and they are now driving north and south, with the latter drift showing good ore. Maguire and Mahana are in 60 ft. with their adit on Oro Belle No. 1, and have a well defined vein assaying about $100 per ton. They will come farther down the hill, sink, and cross-cut for the vein.——Four claims owned by G. A. and W. L. Foster have been incorporated as the Hart Con. Mining Co., and work will begin April 1. The officers of the company are: George A. Foster, president; H. S. McCallum, vice-president, and W. L. Foster, secretary-treasurer and general superintendent.——The Pfunder lease on Oro No. 1 is cross-cutting from the 50-ft. level, to catch a well defined vein east of the shaft which traverses the Pfunder ground and the Big Chief. They will sink to the 100-ft. level as soon as they cut the vein.——Bevere, Barrow, and Furrow have started a shaft on the Rambler, which adjoins Jumbo and Clapper No. 3. Trenching showed good ore on the surface.——From 10 to 15 new people are coming in every day, and the demand for real estate and mining property is strong.

Hart, March 30.

The town of Hart is growing rapidly. A good two-story hotel is nearly finished, police and fire regulations are enforced, and a daily mail service is established. There are about 1000 people, and a large area has been systematically prospected. The best ground is on the Oro Belle claim, where a fair body of ore assaying about $90 per ton has been found.

SAN DIEGO COUNTY.

Increased activity is reported from Dulzura, the new mining district. Prospecting is being carried on over an extensive area, and some rich ore has been found at several points. About 1000 prospectors are in the vicinity, and several claims have been sold. The best property is three miles southeast of the little mountain town of Dulzura, which is situated among the foothills of the Otay mountains, close to the Mexican border line in San Diego county. Rich ore has been found over an area 7 or 8 miles in length and several prospectors have gone to Mexico to obtain concessions over the line. Hotels and stores are being erected, and a good sized town is springing up in the centre of the district.

SHASTA COUNTY.

It is reported that two more dredges will be built by C. A. Wertenberg to operate on the Sacramento river near Redding. These will be suction dredges, similar to the Dubois dredge which is operating at Middle Creek. Several dredges of this type have been built recently, and these are in operation in Shasta county and at Forest hill in Placer county.——The Bully Hill Copper Co. will soon start one of its blast furnaces. The Sacramento Valley & Eastern Railroad is completed, and coke and fluxes can now be hauled direct to the smelter.

The present capacity of the Mammoth smelter at Kennett is 1300 tons daily. The fifth blast furnace will soon be blown in and the output increased considerably. Custom ore is now being treated in the smelter, and it is probable that a large amount of custom matte will also be received from other smelters in California for conversion into blister copper.

COLORADO.

TELLER COUNTY.

The production for the first three months of 1908 from the Work Co.'s properties on Raven and Gold hills is more than $60,000. The greater portion of it has come from the Little Clara lease, operated by Humphreys and Thompson. Twelve lessees are at work on the various properties, and several of them are in ore.——Stafford & Co., lessees on the Midway property of the United Gold Mines Co., loaded a car of medium grade ore recently. The ore is broken on the 250-ft. level and averages $35 per ton. The shoot is thought to be an extension of the Wild Horse vein.

On the Black Diamond claim on Womack hill, under lease to Doepke & Co., extensive development work is in progress on a vein opened recently. Driving on the vein was started from the bottom of the 140-ft. shaft. At present assays indicate that the ore will average 3 oz. per ton for a width of 2½ ft. across the vein. The lessees are rapidly preparing to start a big production. A large body of low-grade oxidized ore, the extent of which has not been ascertained, will be explored. Assays taken from time to time seem to indicate that the whole dike will run about $7 per ton.

Jackson and Redd, lessees on the Amanda claim at Windy point on Bull hill, shipped a car of ore recently that carries 1 oz. per ton. The ore is broken from between the 50-ft. level and the surface. The lessees are looking for a vein which they have reason to believe will be cut in a short time.

There are but two sets of sub-lessees at present on the John A. Logan on Bull hill, and no work is being prosecuted by the Western Investment Co., who hold the lease. Jones and Motchison, lessees on Block 221, will make a shipment of 30 tons soon. The ore is mined in the adit on the property about 800 ft. from the portal. Gold is found in a basalt vein about 2 ft. wide and assays $18 to $20 per ton. Jones and Long, who are operating on Block 220½, loaded a car of ore recently that will assay about 1 oz. per ton. The

ore is broken from an open cut about 15 ft. wide. A streak in the shoot carries $70 per ton, which, with other small stringers, brings the average to ¾ oz. per ton.——Considerable prospecting is being prosecuted by the lessees, and shipping is regular, about 8 cars being loaded out. A steam hoist will soon be installed on the lease, and with the added facilities for production heavier shipments will be made.

NEVADA.

CHURCHILL COUNTY.

A discovery has been reported from an old settlement called Shady Run, about 40 miles east by north of Fallon. Rich specimens of gold ore have been brought to Fallon and many people have rushed to the scene of the discovery.

ESMERALDA COUNTY.

The old workings of the Sheets-Ish lease on the Combination ground caved last week, tipping over the gallows-frame

A Camp Store.

of the vertical shaft. The Consolidated officials have built a fence around the affected area. The ground caved is that which was opened through the incline shaft and which started the apex controversy between the Combination and Mohawk mines. The cave was attributed to the water from the mills.

The value of the week's output from Goldfield is estimated at $148,626, distributed as follows: Combination mill, 685 tons; Goldfield Reduction Works, 839; Western Ore Purchasing Co., 495 tons. The weekly shipment from Tonopah on the Tonopah & Goldfield railroad consisted of 4353 tons, valued at $95,000. This includes MacNamara, 104 tons; Tonopah Extension, 99; West End, 60; Tonopah Co., 2050; Belmont, 660; Montana Tonopah, 1100; Jim Butler, 100; Midway, 180 tons.

HUMBOLDT COUNTY.

Some rich gold ore has been found at Monte Carlo, in the vicinity of the Carpenter Black Diamond mine, within a short distance of the Western Pacific grade between Winnemucca and Hot Springs. The vein is said to be 10 ft. wide, and gold has been found by panning over a large area.

The Wihuja Gold Mines Co., operating the Stoker lease on the Therlen estate, broke into the west extension of the Kindergarten vein last week. High grade ore will be shipped from a 20 in. streak, and a large body of milling ore of good grade is being developed. The ore has been found at the 225-ft. level, about 50 ft. from the place in which rich ore was recently discovered on the Kindergarten. The Kindergarten workings connect with the inclined shaft of the Wihuja Co. on the 150-ft. level, which proves that the recent find is the same vein as that producing rich ore on the Kindergarten.——The lessees on the Eclipse property have recently cut the vein on the 70 ft. level, and found 6 ft. of milling ore with a streak of shipping ore varying from a few inches to a foot.——Work is progressing on the Kindergarten and Mazuma Hills stamp-mills, which are being erected in Seven Troughs canyon. The framework of the Kindergarten mill is completed, and the ore-bins and Wilfley tables are in place. The material for the Mazuma Hills mill has been brought from Lovelock, and also a 40-hp. Fairbanks-Morse gasoline engine. The mill will probably be completed in six weeks.

NYE COUNTY.

(Special Correspondence).—Four mills are now operating in Manhattan, two having a capacity of 10 stamps each, one Huntington mill, and another small plant. It is proposed to increase the capacity this summer.——The Manhattan Ore Reduction & Refining Co.'s plant on Mustang Hill is working on a large ore contract with the Consolidated mine; the ore at present being treated is from the full width of the vein, and runs about $25 per ton; but there are many tons of much higher grade which will be put through separately. This contract will keep the plant running for over six months; meantime the Consolidated is stoping ore, running drifts, and preparing to sink from the 200-ft. level. ——The Thanksgiving has reached a depth of 350 ft. and is cross-cutting east and west, the best ore being in the east drift, and several rich streaks have been encountered. The average grade of ore is over $50 per ton. At the annual meeting to be held in a few days the subject of erecting a company mill and proceeding to sink to the 450 level will be taken up. As soon as the Canyon Milling Co. completes the installation of a cyanide equipment they will treat a small lot of high grade ore from this property.——The Canyon Milling Co. is doing good work on small lots of ore, and has already made clean-ups from the Riggs-Lalime lease on Litigation hill, the Wolftone mine, the Plamanez lease on Union No. 9, and others. By taking these small lots, running from 100 to 500 tons, lessees are enabled to do steady work, paying for same with their returns.—— The Nevada Milling & Ore Purchasing Co. has been treating ore from the old Briggs-Evans-Sinclair dumps on Union No. 9 and from the Rose-Nash lease on Union No. 4.——Now that the town is equipped with mills, lessees are commencing to operate. On the Breyfogle estate, adjoining the Thanksgiving on the southwest, the Poak lease is continuing the main shaft from the 250-ft. level to pick up the rich ore-shoot of the Thanksgiving at depth. The Putney lease on the Gold Wedge estate is down 250 ft. and has done over 200 ft. of cross-cutting, having gone through several

At Dulzura, California.

veins of fair milling grade. This lease is being actively developed. Two lessees are operating on the Buckboard claim, adjoining the Litigation Hill tract. On the Seyler-Humphrey estate four lessees are operating. On the Litigation hill ground are the Rose-Nash, Riggs-Lalime, Wilson McNeil, Stewart, Watson, and other lessees, all doing good work. On the Earl claim two lessees are working, the Lorman lease having just run into some high-grade ore, similar to the rich streaks encountered on the Rose and Riggs leases at the 75-ft. level.——Thanksgiving hill is about a mile from Litigation hill, and to the south of that hill lies Gold hill, about half a mile distant, from which all the early shipments of high grade were made by the Union No. 9, Stray Dog, and other lessees.——The small plant of the Manhattan Milling & Leasing Co. is treating rich ore from

the Shea-Davis lease on Union No. 9.——The Mineral Hill property, situated over the East Manhattan range of hills, has good ore in the lower workings, and the management is arranging to install a power plant for deeper working. The present main shaft is down over 200 ft., with several hundred feet of underground workings.——The Otero, adjoining the Mineral Hill, is down over 250 ft., with considerable underground development. This property is equipped with power plant for deeper work.

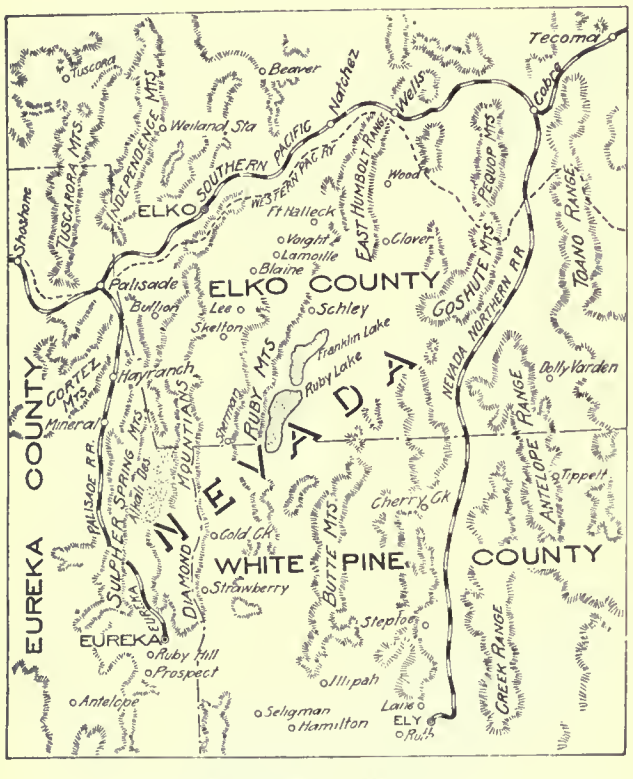
Manhattan, March 31.

LINCOLN COUNTY.

The Victor-Queen Bee Mining Co. is reported to have found some rich ore in Eldorado canyon. Tellurides have been found in a vein 8 ft. wide.

WHITE PINE COUNTY.

The Alpha shaft of the Giroux Con. Mines Co. has been repaired to the 1000-ft. level, and as soon as it is cleared to the 1100-ft. level, sinking will be resumed, and regular



Map of Eastern Nevada.

cross-cuts and drifts driven at each level. The water now developed in the shaft amounts to 70,000 gal. per 24 hr., and this will be used to run the concentrator for one shift. The rest of the water for the 600-ton mill will be supplied by a pipe-line from the Magnuson ranch, five miles east of Ely, where the company has a water-right. Reports state that 4,000,000 tons of concentrating ore and 350,000 tons suitable for direct smelting are in sight.——Excitement continues at Blaine, and many people have left Ely for the scene of the discovery of some rich ore. The Granite district has attracted large numbers. It is 30 miles north of Ely, about 5 miles from the Nevada Northern railroad. An important discovery is reported in the old workings of the Blaine tunnel. The vein is said to be wide and of good value.

IDAHO.

SHOSHONE COUNTY.

(Special Correspondence).—The Snowstorm mine, which has been running with a crew of 60 men and putting out about 100 tons of ore per day for several weeks, has increased its output to 250 tons, and has added 40 men to its crew. This was brought about by contracting with the Trail smelter at Trail, B. C., for 150 additional tons, its previous contract being two or three carloads per month.——The Last Chance mine at Wardner has again suspended operations. The Standard and Mammoth is now the only mine of the Federal Smelting & Refining Co. in operation.

Spokane, March 30.

UTAH.

PARK COUNTY.

The recent find on the Wabash property at Park City is important. The work being done on the new vein is on the 1400-ft. level. A drift has been run for 250 ft. along the hanging wall of the vein. A cross-cut has been driven 86 ft. which proves the vein to have a true width of about 50 ft.——A new company has been incorporated to develop the old Sunshine mine in the Mercur district. The officers include several officials of the Con. Mercur Co. The property includes a mill which is in fair condition. The ore is similar to that of the Con. Mercur mine, on which such good work has been done by the mill recently erected by that company, so that the metallurgical treatment of the ore will present no serious difficulties.

WASHINGTON.

OKANOGAN COUNTY.

(Special Correspondence).—The Grant Con. Copper Mining Co. has made its final payment on the bonds covering the group of claims it has been operating near Chesaw, Wash., and has received a deed to the property. The last payment was $12,000, and completes $100,000 expended on the property by the Grant company since it took the bond a year ago. Development has been steadily carried on, and two veins have been cut in the adit, both containing high-grade chalcopyrite. The main lode was tapped by a short adit near the summit of the hill, and showed ore of shipping grade. This was followed up by a long adit lower down, which several weeks ago passed through a mineralized lode 46 ft. wide in which some concentrating copper ore was exposed. The adit has now reached the second vein, which was cut above, and it is found to be mineralized, but as yet no ore has been found. A railway spur has been assured when ore is exposed in paying quantities, and it is probable shipments will be made this summer.

Chesaw, March 27.

SPOKANE COUNTY.

(Special Correspondence).—The Pend d'Oreille Dredging Co. has been organized in Spokane to dredge for gold at the confluence of the Pend d'Oreille and Columbia rivers. The rich deposits of gold known to exist along both streams has led to the supposition that in the eddy at this point gold may have been deposited in the pot-holes at the bottom. It is well known that at many places along these rivers, especially the Pend d'Oreille, the same ground is worked year after year, the gold being brought down with succeeding freshets. No one, however, has ever succeeded in dredging the depths of the river at this point, although companies have been organized for this purpose. Frank F. Fullmer has now located one claim and will make the attempt to reach this gold. He has now gone to the East to examine dredges with the view to securing one able to bring up a heavy load from great depth.——It is reported here that a deputy sheriff has seized the mines and smelter of the Sullivan Group Mining Co. for debt, the amount being about $1600, representing the earnings of a number of workmen who have not been paid by the company. The Sullivan closed both mines and smelter the last day of February. Confirmation of this news could not be gained at the company's headquarters in this city, and the belief was expressed that the mines and smelter could not be seized in this manner, as they are already in the hands of trustees for the bondholders. The management issued a letter from its Spokane office March 17, stating that an assessment of 7 c. per share would have to be levied in order to pay off $225,000 owing to the Federal Smelting & Refining Co., and a floating indebtedness of $50,000. Answers to this proposal have not yet been received, but it is stated by the management that if this meets with approval by the stockholders, all financial difficulties will be cleared up, and operations again resumed.

Spokane, March 28.

STEVENS COUNTY.

The Cedar Canyon Smelting & Reduction Co. has a bond and lease on various mines near Deertrail which produce copper sulphides and lead and silver ores. It also has a lease on the Turk smelter, which consists of a Blanchard wood-burning blast-furnace, which did not prove a success. The ore has been hand-picked and the higher grades shipped to Tacoma. It is proposed to remodel the old smelter and resume operations with coke. Deertrail is 25 miles from Springdale and 35 miles from Davenport, on the Northern Pacific railroad. The freight rate is $6 to Tacoma and treatment charge is $8 per ton. The shipping ore assays over $50 per ton.

WHITMAN COUNTY.

(Special Correspondence).—The Mizpah Copper Mining Co. held its annual meeting at Palouse a short time ago and elected the following officers: President, C. E. Frederick; vice-president, J. C. Northrup; secretary, H. C. Johnson; treasurer, W. F. Chanler. The statement showed that $20,000 had been expended in development during the year past. It was decided to begin operations soon, and place the mine on a shipping basis as soon as possible.

Palouse, March 27.

CANADA.

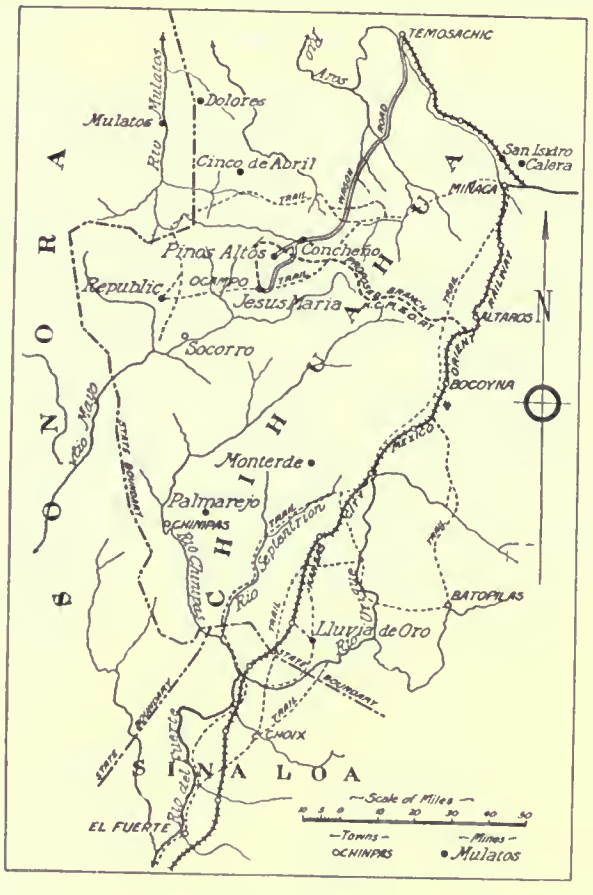
BRITISH COLUMBIA.

Improvements at the Granby smelter are being made which will cost $200,000. New ore and coke bunkers are being built, and the blast-furnaces are to have new water-jackets, and will be made 4 ft. 4 in. longer, making them a length of 22 ft., and increasing the capacity of the plant by 1000 tons per day. The converter plant will be entirely renewed. At present the converter plant can only just handle the product of the furnaces, though operating at full capacity 24 hr. per day. The present three converters are 70 in. diam. and 100 in. long, and the three new converter stands will be 84 in. diam. and 126 in. long, there also being 10 new shells. To make room for the enlarged converter plant, the steel converter building will be lengthened 80 ft. The new converters will be electrically operated, the first of this type in the Boundary district, and will be operated by 25-hp. electric motors. In the blower building the engine capacity will be doubled. At present the engines have 500 hp. capacity, and a new 500-hp. engine has been ordered, with a 500-hp. motor to drive it. It will be of double-cylinder type, capable of furnishing 10,000 cu. ft. of free air per minute with 15-lb. pressure, and will be, like the others, of Nordberg make, from Milwaukee. To supply the additional blast needed for the furnaces, necessitated by their being considerably lengthened, contracts have been let for two new Connersville blowers, each having a capacity of 30,000 cu. ft. of free air per minute. To operate these blowers there will be four 150-hp. electric motors, all new ones to be of Canadian Westinghouse type. With the enlargement of the blast-furnaces will also be required additional trolley engines to haul the feed cars from the coke and ore bins. Four of these trolley engines, each 30 hp., are now on the way to Grand Forks from the makers in the East. All of the above machinery has been contracted for with the explicit provision that it is for delivery on or before July 1. As soon as it arrives the work of installation will be at once started, one furnace being changed over and enlarged at a time. This will slightly cut down the smelting capacity for a short time, but when one or two furnaces are enlarged, the increase in size will make up for other furnaces being out of commission temporarily to undergo the same change.

The Blue Bird mine has developed a vein of rich ore four feet wide. The adit is driven a distance of 50 ft. and a machine-drill is being used. The work is being done by lessees.——The Nest Egg has been leased to Morrish, Grant, and Harvey. There is a shaft 75 ft. deep on the property, and an adit is being driven to tap the water in it.—The following shipments were made last week: Rossland district—Centre Star, 3270; Le Roi, 1865; Le Roi No. 2, 665; Evening Star, 35 tons; Boundary district, 25,388; Slocan-Kootenay, 1969 tons.

ONTARIO.

(Special Correspondence).—Discoveries of rich silver veins in the unsurveyed part of Lorraine township, near the Cobalt camp, have caused a rush to that district, where many new claims are being located. Several of the new veins have been located near the properties owned by the Cobalt Central Mines Co., upon which as yet no development work has been done. At the Josey claim, which is one of the new locations, 250 bags of high-grade silver ore are already sacked and are now being hauled to the shore of Lake Temiskaming. Twenty tons of silver ore from this new district will be shipped in the early spring. The discovery of silver outside the Coleman district, where the producing mines are mostly situated, is important. The new vein on Lot 38 of the Cobalt Central has turned out to be as rich as the No. 2 vein on Big Pete, and promising new veins have been encountered on the Right of Way, Silver Queen, Nipissing, Tretheway, and several other properties, The new No. 4 vein on the Silver Queen is now one of the richest veins in the camp. Two other good discoveries have been made on this property within 1000 ft. of the main shaft. Even the low-grade ore in the Cobalt camp is now



Map of Part of Mexico.

being shipped at a profit. The Nancy Helen has just shipped 40 tons of low-grade ore across the continent to the Consolidated Mining & Smelting Co.'s smelter at Trail, British Columbia.

Cobalt, March 25.

MEXICO.

Ore is being shipped by the Fe, Cavidad y Anexas Mining Co. from its Los Leones property in the Guachinango district to the Aguascalientes smelter.——The Mexican Agency Ltd. of London has taken an option to purchase a controlling interest in the Mina Grande, on the Santiago river in the Hostotipaquillo district. The Mina Grande is an 'antigua' that was worked from an enormous surface cut 500 ft. wide. Some of the pillars left in the mine are rich in silver and gold. By driving an adit from the adjacent river, a depth of several hundred feet below the old workings can be obtained.——Work has been begun on the erection of a cyanide plant and an electric power installation to be used in connection with the El Salto mill of the Green Gold-Silver Co.

Special Correspondence.

LONDON.

The Chartered Company.—Financial Arrangements.—The Spassky Copper Company.—A Spanish Copper Fiasco.

A few weeks ago I recorded in this column the propositions made by the directors of the British South Africa Company for the raising of further working capital. I mentioned that the scheme was to offer £1,000,000 of new shares for subscription at par, with the right to subscribe for further issues at the same price during the next three years. I pointed out that the present price for shares in the market was 15 shillings and that self-preservation and patriotic feelings were the only inducements that could be used in appealing for subscriptions to the new issue. Unfortunately this issue has not been a success, and the directors have been obliged to withdraw it. A variety of causes can be given for this failure. One is the general stringency of money. It is possible that in times when people had more cash the money might have been raised. Another contributing cause is the feeling that Rhodesia must be governed on a different basis, and that a position of aloofness on the part of the shareholders would do a good service in hastening the denouement. Thirdly, the hope of a dividend is so remote that shareholders do not care to put up any more funds. Be this how it may, the directors have now submitted an alternative offer. This takes the form of the issue of £1,000,000 in second debenture stock, bearing interest at the rate of 5½%, as part of £1,750,000, which it is proposed to create. These debentures will rank next to the first mortgage debentures, of which there are £1,250,000 bearing interest at the rate of 5%. The holders of the £1,000,000 of second debentures will have the right to convert their holdings into ordinary shares and to subscribe for two more ordinary shares at par during the next three or four years. It is by no means clear that this proposition will be any more acceptable, for there is no guarantee that the company will be able to pay the interest. A month ago, when I wrote my paragraph about the issue of new shares, I do not think that the public quite realized the seriousness of the position of this company, and my view of things may have appeared sentimentally exaggerated. Since then the state of affairs has been more accurately gauged, and it is quite probable that sufficient shareholders will now come forward ready to make some sacrifice for the sake of the Empire.

The directors of the Spassky copper company are bringing forward a proposition for the purpose of providing suitable equipment on a large scale. This mine, as your readers are aware, is in Siberia and contains one of the most solid deposits ever discovered. I gave full details of the mine as then developed in another place some two years ago, and my article appears in Weed's 'Copper Mines of the World,' so that it is not necessary to enter into any great detail now, except to say that further developments at depth show that the ore continues to be of the same high grade. Originally it was hoped to pay for equipment out of income from the high-grade ore, but more recently it has been suggested to the directors by several prominent men that full advantage of the high and low-grade ores can only be taken by spending money out of the capital for the purpose of erecting suitable plant and equipment. It will be remembered that Pellew Harvey & Fell have had the development of the property in hand, and that E. T. McCarthy confirmed all their estimates and views. More recently W. A. Heywood went from America to report on the ore treatment, and M. Robellaz of Paris examined the property on behalf of French capitalists. The last two gentlemen have strongly recommended the provision of this new capital. It is proposed to increase the share capital from £300,000 to £500,000, and the debenture issue from £129,300 to £300,000. At the present time it is only intended to offer the new debentures for subscription, which will provide funds amounting to £170,700. Of the new share capital, £100,000 will be held against the conversion of the debentures, and the remainder will be reserved for future issue whenever it is considered advisable further to develop the coal mines belonging to the company. The present issue will be used in completing the construction of the railway from the mine to the smelter, and building coke-ovens. It will also provide concentrating plant for treating the lower-grade deposits, which it is advisable to treat concurrently with the higher-grade ore, in order to supply the necessary sulphur for treating the latter. The coal mines at Karagandy promise to become an important asset of the company. They are sunk to 240 ft. and extensively developed, and are opening up practically inexhaustible quantities of good coal. The railway from the coal mine to the smelter, 26 miles, is already completed, and the smelting plant capable of producing 300 tons of copper per month is now ready to commence work. The present issue of debentures, which bear interest at 6%, should be an attractive investment.

A copper mine of recent flotation that has done badly is the San Vicente, which was floated with others as the Anglo-Spanish Copper Co. just a year ago. The mine is in

On the Zambesi.

the south of Spain, just on the border of Portugal, and is situated about half-way between the Bason & Barry and the Tharsis properties. It belonged for many years to Señor Yglesias and his friends, who first tried to sell it to the adjoining companies and subsequently attempted to work it themselves. A year ago it was sold in London to the Anglo-Spanish Copper Co., which was formed for this special purpose. The people who put up the money in London were eminent men connected with the metal trade, and the prospects seemed exceptionally good. A short time after the flotation the company appointed Charleton Dickinson & Co. as consulting engineers, and the directors were considerably disturbed when they received this firm's report. The report was not at all favorable; in fact, the firm was obliged to say that Mr. Rivington, on whose report the company was floated, was quite mistaken as to the extent and value of the ore deposits. The directors, after consultation with some of the principal shareholders, agreed to the proposal of the French shareholders that Messrs. F. & F. Gouin should go out to make a further examination. This was done, and their report confirmed that of Charleton Dickinson & Co. The shareholders who had put up the money on the flotation subsequently met together and determined to request the vendors to take back the property

and expend no more of the shareholders' money. The vendors had taken most of their purchase price in shares of the company and, in fact, exercise the control. They hold 165,000 shares, while the English subscribers hold 90,000, on which only 10s. per £1 share has been called up. If the company went into liquidation the uncalled capital as well as the funds in hand would have to be distributed equally among all the shoreholders, including the vendors, which, of course, would be an injustice, if the vendors had had any idea that the properties were not what they claimed to be when the deal was carried through. In order to prevent the money being wasted or divided among the vendors, the subscribers who bought the shares are taking steps to prevent such a liquidation, and are pushing the vendors pretty hard in order to get them to accept a more reasonable proposition. Probably in the end some compromise will be adopted, and the more violent means of alleging fraud in a court of law will not be resorted to.

DENVER, COLORADO.

Activity at Leadville.—The San Juan Region.—Output of Cripple Creek.—New Reduction Works.—Attempt to Kill Bulkley Wells.

An attempt was made to kill Bulkley Wells, the manager of the Smuggler-Union mine. It happened in the very house in which Arthur L. Collins was so brutally assassinated in 1902. At 2 o'clock on the morning of March 28, a charge of dynamite was set off under Mr. Wells' bed. There is no question but that it was dynamite, as no remnant of a containing vessel was found, and the explosion was severe enough to tear a large hole in the floor, wreck the bed, and blow out window-lights in adjoining rooms, although the room in which the explosion occurred was open on two sides, being protected merely by wire screen. About half a dozen sticks of dynamite must have been used. Whoever placed the powder obtained access to the room by forcing a bathroom window on the same floor and entering it by means of a ladder. This was done about midnight or a short time afterward, as it had been snowing during the evening, but stopped a few minutes after midnight. The ladder was thrown to one side, and had a slight film of snow on it. The powder was evidently placed by one familiar with the place, with Mr. Wells' habits, and his whereabouts. He was in town during the evening, and had gone to bed only a few minutes before the explosion. These facts indicate a timing device, but no evidence of any could be found. Undoubtedly what saved Mr. Wells' life was the heavy mattress he was sleeping on, and the open sides to the room. He was thrown to the ceiling, but suffers only from shock and various bruises and minor cuts. The would-be assassin is as yet unknown. The motive given greatest credence is that Wells is the principal witness for the prosecution of Stephen Adams, for the murder of Arthur L. Collins. The trial is set for May 12, and it is supposed that the Western Federation wants to get Wells out of the way. Agents of the Federation are at present in the county trying to get expressions of opinion from men whose names are on the jury list, as a basis for a change of venue. It would also help their case to have local citizens attempt violence, as well. Should Adams be lynched, he and his secrets would not longer menace the Federation. Mr. Wells was a witness in the trial of Haywood and Pettibone at Boise. He has always been fearless in his opposition to the anarchists who have committed so many unpunished crimes in Colorado, and he incurred their hatred first by organizing a military company at Telluride and then by becoming Adjutant-General of the State militia, taking a prominent part in the troubles at Cripple Creek.

The strike of the Denver & Rio Grande shop employees continues. Numerous attempts have been made to arbitrate the points at issue, but without success. The railroad management adheres strictly to its first proposition, namely, that it will operate its shops under the 'open' policy and no other.——The citizens of Leadville have organized an association and appointed a committee to revive the interest in prospecting and developing new territory surrounding this famous camp. It would seem an opportune time to arouse interest in this district, so notable through its long and steady output, and especially in view of the recent gold discoveries in the outlying districts. The Dinero adit under Sugarloaf mountain is passing a heavy flow of water, and the old shaft workings, 600 ft. overhead, will be open to inspection very soon. Work has been resumed at the Highland Chief, which was closed last November. Emil Vernier and Robert Shipley are the lessees. Two new tunnel projects are to be started as soon as the weather permits; one is to start from Colorado gulch with the object of cutting the Tiger Shields and Venture lodes. The other adit starts in Gleason gulch, in the St. Kelvin district, and is to extend to a point under the old Berdella shaft, a distance of 4000 ft. The St. Kelvin Mining & Tunnel Co. has been organized recently to carry on this project.

The San Juan region is becoming active earlier than usual. The St. Paul Mining & Milling Co. has been incorporated, with a capitalization of $100,000, to operate the St. Paul mine, which was once a rich producer, in the Red Mountain district, near Silverton. At Telluride, the Smuggler-Union Co. is gradually increasing its working force as desirable miners apply, and the Lewis mine in Bridal Veil basin is being unwatered by lessees preparatory to making a test-

The Smuggler-Union Mill.—The House to the Extreme Left is the One in Which Arthur L. Collins was Assassinated and in Which Bulkley Wells was Attacked.

run at the mill. The T. M. C. tunnel, north of Lake City, is advancing again. The work is being done by hand. On Henson creek, in the same locality, work has been resumed on the California tunnel.

The output for March from Cripple Creek was not quite as large as it would have been had transportation facilities been adequate. This has affected the small producers and dump lessees most, but as their output is of lower grade for the most part, the total value shipped for the month will not be seriously affected. The Stratton's Independence cyanide mill has been completed and tested until perfectly satisfactory results have been obtained. This mill was designed by Philip Argall. It is up to date in every respect, employing the best features in American and foreign practice. The capacity of the mill is 6500 tons per month. Only low-grade oxidized ore from the Stratton's Independence dump and mine will be treated. Work on the Trilby mill is being pushed as rapidly as possible. Most of the machinery is in place. This plant has a Pearce roaster for treating the unoxidized ore from the mine. The Rocky Mountain smelter, at Florence, which was purchased three months ago by the Troy Consolidated Mining Co., is being thoroughly remodeled, and the roasters are being rebuilt. The company owns claims at Cripple Creek, and will treat custom ore as well as its own. Progress on the drainage adit has averaged 9 ft. per day for the past two months, with two shifts, and three shifts are now being tried in an endeavor to make a record.

SALT LAKE, UTAH.

Resumption of Work. — New Enterprises. — Utah Consolidated Smelter. — Daly West Report. — Boston Consolidated.

The Boston-Sunshine Gold Mining Co. has been organized to operate the Sunshine mine in the Camp Floyd district. The property is equipped with a good milling plant and a slime department is to be added without delay. A. W. Chesterton of Boston, one of the directors of the Consolidated Mercur Gold Mines Co., is president.——The May Day mine in the Tintic district will return to the list of producing mines this week, after having been closed down since the beginning of the year on account of the low metal market. It is expected that several other properties that have been inactive for some time will re-open during the present month. In May others will follow, as the Tintic Smelting Co. will shortly be ready to receive custom ore.

A special meeting of shareholders of the Ohio Kentucky Consolidated has been called for April 6, at which time the matter of increasing the capital stock will come up for consideration. This company is operating in the Ploche district, but Salt Lake is the headquarters.——The capital stock of the Federal Ely Mining Co. has been made assessable at a special meeting of shareholders, and the directors have authorized a levy of 5 cents per share. This company owns some valuable mining property and water-rights in the Ely district, Nevada.

The Utah Consolidated is going to commence the construction of its proposed new smelter in Tooele county. The announcement has been made that all the options and smoke easements on lands required have been obtained, and therefore nothing stands in the way of the company going ahead to erect a plant to take the place of the one near Murray which was forced out of business through unfavorable court decisions resulting from the trial of the smelter-smoke cases. The Utah Consolidated has purchased outright 1200 acres of land in the vicinity of the smelter site, which is in Pine canyon four miles above the town of Tooele and 15,000 ft. from the company's mines at Bingham. The mine and smelter are to be connected with an aerial tramway. It is planned to operate an electric trolley road between the smelter and the town of Tooele, where employees of the company will make their homes. The company will own and control about 21,000 acres, all within a radius of five miles of the smelter. A unique plan has been hit upon to avoid trouble in the future. The valuation of the lands optioned to the company having been fixed, owners are paid 10% of the stipulated value per acre in cash. In case damage accrues through the operation of the smelter, the company agrees to take up the option and accept a deed. If the land-owner sees that he has suffered no damage or prefers to keep his property, he can do so; but the cash received from the company is retained.

The annual report of the Daly West Mining Co. has been issued to shareholders, and covers the operations at Park City during 1907. The exhibit shows that 24,856 dry tons of crude ore, concentrate, and miscellaneous ore was sold during the period stated, the same bringing $771,679; the sum representing the total valuation of 8,086,456 lb. lead, 949.91 oz. gold, 1,042,062 oz. silver, and 5,111,060 lb. zinc produced. The crude ore averaged 43.13 oz. silver, 0.04 oz. gold, 13.43% lead, 1.4% copper, 7.8% zinc; selling at $28.51 per ton. The concentrate averaged 54.54 oz. silver, 0.04 oz. gold, 28.15% lead, 1.53% copper, 15.4% zinc; selling at $48.85 per ton. The miscellaneous ore, which came mostly from lessees, averaged 30.10 oz. silver, 0.032 oz. gold, 9% lead, 1.14% copper, 8.2% zinc; selling at $18.33 per ton. On account of labor troubles the mine was closed down from Sept. 25 to Nov. 15. Since the incorporation of the Daly West company in 1892, there has been produced from the mine 13,467,032 lb. copper, 84,893 tons lead, 16,113 oz. gold, 19,591,822 oz. silver, and the receipts from the sale of this product were $11,975,099.

Samuel Newhouse assures Boston Consolidated shareholders that there is no ground for anxiety. A change in the method of mining has hindered production, but this is to be remedied within 90 days. The new mill is doing well, even under adverse conditions, and is making a saving of 66%. Mr. Newhouse has made an offer to put up his property at Salt Lake against Boston Con. stock at $15 per share, as proof of his sincerity.

MEXICO.

El Oro.—The Hostotipaquillo District.—Mololoa and El Favor.—The Mitchell Co.—General Revival in Mexican Mining.

In the State of Jalisco the country about Hostotipaquillo, north from Etzatlan, is rapidly coming to the front and foreign capital is being invested, encouraged by the great amount of work being done out from Orendain (25 miles west of Guadalajara on the Mexican Central Railroad) by the Southern Pacific line to Guaymas, which line must pass near the Hostotipaquillo district. The Virginia-Mexico Co., with large holdings in this district, successfully weathered the financial storm, met its payments when due, is now transporting from Etzatlan the machinery for a 30-stamp battery, two tube-mills, Wilfley tables, and cyanide vats, and has ordered some 300 hp. of electrical equipment. The Casadas Co. has unwatered that property and has verified the old data, to the effect that the 'ancients' were working in rich ore when driven out by the water. A fine body of ore has been encountered in the bottom, and the character of it is such as to indicate that the workings are on the northern extension of the old Mololoa-El Favor vein, so that now work is to be started on a new and permanent working shaft. Canadian and English capital has bought for $80,000 gold the Mololoa, which, with the exception of the Albaradon, is about all that remains unsold of the large holdings obtained by Carlos Romero, at ₱500,000 from the estate of De la Parra, in Guadalajara, a year ago last fall. The Mololoa is a splendid old property and should open up with proper development, which will be directed by Frank G. Stevens, formerly in charge of El Favor for the Makeever Bros. For El Favor it was claimed that over ₱8,000,000 worth of ore was blocked out in one year's development work, and that ₱88,000 worth was shipped without stoping. The property is now said to have over 300,000 tons of ore blocked out that will average above ₱30 per ton, and it is reported that an English company has just obtained the property under a bond for ₱4,000,000. Whether it is the same company that has taken over the Mololoa above mentioned has not yet been ascertained. W. R. Ramsdall, president of the Casados and Tenemache M. companies, and vice-president of the El Favor Co., who has been the leading promoter in most of the large Hostotipaquillo deals, has obtained control of the Expectativa mine, 10 miles southwest of Ameca, at the rate of $200,000 for the whole, and will at once organize a company for its proper development. The aerial tram and 40-stamp (150 ton) concentrating and cyaniding plant of the Amparo Co. of Etzatlan, built and completed last fall after the results of the experimental plant placed at the mine in 1905, had been seriously damaged by the caving of some of the foundations, but it is expected to have the mill in working order again in a few months.

Ever since the coming to Mexico a month or so ago of Walter Harvey Weed and W. H. Stevens there have been persistent rumors to the effect that the Tennessee Copper Co., with which they are both associated, was seeking investment in Mexico, but nothing could be learned further than that it was probably in the Balsas River district of Guerrero. Now it is definitely understood that Messrs. Weed and Stevens have made a complete examination and thoroughly sampled the La Dicha properties of the Mitchell Co. in Guerrero, and that for this purpose the workings were all unwatered, under the directions of E. E. Noon, who has for some years been the superintendent at La Dicha, and was present during the examination. Messrs. Weed and Stevens have returned to the States and undoubtedly the results of their examinations will soon be made public, while in the meantime Mr. Noon is awaiting orders. It is certainly to be hoped that as sensible and practical a company as the Tennessee Copper is known to be, may take hold of this La Dicha property, which, it is believed,

under proper management should develop into a highly profitable enterprise. And nothing could be more beneficial for the State, for there are many mineralized belts throughout Guerrero to attract capital, once it is directed that way. The mere fact that this examination has been made, following so closely upon that of the Chihuahua and the Potosi companies of Santa Eulalia, Chihuahua, by Chas. M. Schwab and associates, cannot but help have its tonic effect upon the conditions of the mining industry in general throughout the Mexican Republic. As yet nothing has been heard regarding the Chihuahua and Potosi deal, but if "silence is golden," it will take quite a lot of it at just this time to get together the $8,000,000 which are said to figure in the Chihuahua-Potosi transaction, and it may be some little time before we hear any more noise. In the meantime these properties continue their production of some 400 tons per day.

There is no doubt but that throughout the entire Re-

Western Australia.

public mining interests are recovering from the set-back of last fall. A number of mill and small reduction plants are in course of construction, and the properties that have mills in running order are greatly increasing their production, as are also those that ship direct to the smelter. And even the copper properties that closed down because of the drop in that metal are finding that they have ore that can be shipped even under present conditions. The Government is doing all in its power to encourage a more bopeful feeling at this time by postponing until July 1 the inauguration of the new freight rates on ores. This, it will be remembered, was in effect a re-classification of ores into three heads: those of less than ₱25 valuation, those between ₱25 and ₱50 valuation, and those over ₱50 valuation per metric ton, and a general increase in the freight rates of practically 10%, 20%, and 30% respectively in the three classes. This was a great reduction from the rates which the railroads had wished to put in force, but had been decided upon as a kind of compromise and was to go into effect on April 1. Representatives of mining and smelting interests have shown the Government how unwise it would be to put this additional burden upon the mines at this time, and it is generally believed that the Government will hold the new rates back until July 1, at least.

KALGOORLIE.

Production Declining.—Important Discovery in the Great Boulder.—Filtering Devices.—Methods in Use.

The current year opened with mining generally on the down grade. Our mines are extracting big tonnages, but the assay-value is lower and consequently profits are suffering, in the majority of cases.

In 1907 the gold yield of Western Australia was valued at $36,000,000, against $38,000,000 in 1906; of this Kalgoorlie produced fully $19,000,000. The dividends paid last year totaled $8,500,000, against $9,800,000 in 1906; while the mint at Perth dealt with bullion valued at $26,500,000, against $26,000,000 the previous year. Its annual capacity is about double these amounts.

The ore reserves in most of our mines are fairly large, but the grade is lowered every year; and while poorer ore is encountered in some, it is of interest to know that in the Golden Horseshoe, Ivanhoe, Kalgurli, and especially the Great Boulder mines, the deeper workings show good ore.

During the past week two most interesting and important developments were announced from the Great Boulder. The first referred to diamond-drilling at the 1000-ft. level; a vein was cut 12 ft. wide, assaying $45 per ton; but the finest development this district has seen for some time was that at the 2200-ft. level, where they had driven on the main lode between the Main and Edwards shafts for 300 ft. in ore assaying $29 per ton for 5 ft. wide, while the present face is worth $70 per ton. The following are the published ore reserves on December 31, 1907:

	Tons.	Yield per ton.	Profit per share
Associated Northern	141,181	$13.00	$2.50
Great Boulder	650,870	18.00	4.00
Golden Horseshoe	1,062,322	13.00	15.00
Kalgurli	650,000	14.00	27.50
South Kalgurli	111,039	7.50	0.50
Perseverance	461,598	7.50	0.50

Profit per share is obtained by deducting from total value of reserves every possible expense, including the loss in residue. On several of the smaller mines, on the fringe of the Golden Mile, a good deal of work is being done in the oxidized portions by parties of tributers, who are doing fairly well on the average. They pay a royalty on gold won as usual.

As regards the treatment of ore here, there is little change. The Ridgway plant of 10 machines at the Great Boulder is working fairly satisfactorily. At the Lake View Consols a Cassel plant is being erected to treat the residue-dump, which contains well over 500,000 tons. A Cassel or Butters plant treating 150 tons daily of oxidized slime is doing good work on the Croesus mine. The Sons of Gwalia, one of the large mines in the interior of the State, has also a plant of the same design at work, but whether on old slime or fresh battery slime, I do not know. Apart from these departures, the filter-press still holds its own on the treatment of both roasted and unroasted ores in this district.

The Associated, Kalgurli, and Perseverance use dry crushing, roasting, grinding-pans, and filter-presses. The Lake View Consols and the Oroya-Brownhill employ wet crushing, concentration, pans and tube-mills, bromo-cyaniding, and filter-pressing. The Ivanhoe, Golden Horseshoe, and Hainault use wet crushing, concentration, pans and tubes, sand-treatment in vats, and filter-pressing of slime. At the Great Boulder the Ridgway machines are treating the old slime-dumps containing hundreds of thousands of tons, worth about $2.50 per ton. Presses are at work on the mill-product.

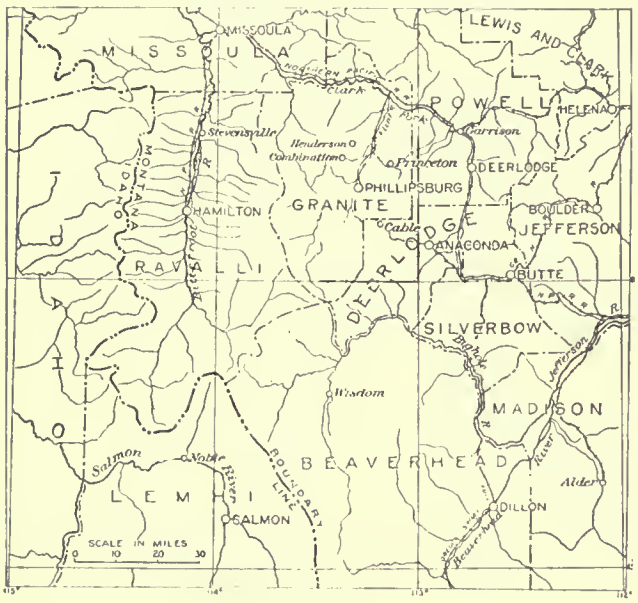
BUTTE, MONTANA.

Copper Production in March. — Resumption of Work. — The Fire Underground.—East Butte.—Gold Discovery.

In March the Butte mines produced 18,127,250 lb. copper from 584,750 tons of ore, the different companies contributing as follows:

	Tons of ore.	Pounds of copper.
Boston & Montana	210,000	6,510,000
Anaconda	162,500	5,037,500
Butte & Boston	18,600	576,600
Washoe	18,900	585,900
Parrot	4,000	124,000
Trenton	9,000	279,000
North Butte	80,000	2,480,000
Butte Coalition	32,000	992,000
Original	38,500	1,193,500
Miscellaneous	11,250	348,750
Totals	584,750	18,127,250

The Parrot and Neversweat mines of the Amalgamated are still closed, but all the other producing mines of the district are being operated again, and some of them at their



Montana.

normal capacity. The North Butte was the first to reach that stage, and is now shipping about 1300 tons of ore per day to the Washoe smelter at Anaconda. The Butte Coalition is still confining its work to the Rarus mine and is mining 900 to 1000 tons of ore per day, much of it first class. Three levels of the Rarus mine are all in first-class ore, and new orebodies are being opened in the Minnie Healy. Shortly, the latter property will be mined again, but the work will be carried on through the Tramway shaft, owned jointly by the Coalition and Butte & Boston, which is now 1400 ft. deep, at which level and at the 1300 connections are being made with the Minnie Healy. The operations in the latter will be below the fire, and will not be interfered with by gas or fire.

Gas arising from the fire in the West Colusa, Leonard, and Minnie Healy mines again drove out the miners last week, and some experienced men who have been working near the fire say the companies never will be able to extinguish it, and that the only thing they can do is to restrict it and get it under control, as the Anaconda Co. had to do with the fire in the St. Lawrence mine, which has been burning since 1889. While the fire in the St. Lawrence makes the mine very hot and uncomfortable in some portions, it does not otherwise interfere with mining, as it is completely walled in with a wall of cement, and is confined to its original limits. That will probably have to be done with the fire in the Coalition and Boston & Montana mines. In the Minnie Healy the fire is confined to old stopes on the upper levels and will not interfere with work on the lower levels through the Tramway shaft, but the gas arising from the fire has repeatedly driven miners out of the Boston & Montana mines and has prevented much work in the Minnie Healy. The Boston & Montana Co. is doing nearly all the work of fighting the fire. It is engaged in sinking three or four shafts for the sole purpose of creating a draft and ventilation, and get at the fire with water.

Notwithstanding statements to the contrary, the lessees in the East Butte mines are confined in their mining to the 400 ft. level and the levels above that. No mining has been done below the 400, but some good orebodies have been opened by the company on several levels down to the 900 ft. station, containing a large quantity of first-class ore. Recent developments in the property have disclosed the fact that large orebodies are known to exist at depths that have not yet been opened by the East Butte, but were known by the Butte & Boston Co. years ago, before it became a part of the Amalgamated. There is no doubt that the East Butte when it is able to resume sinking and development work, will develop into an important producing company.

A rich strike of gold quartz has been made in the old Highland district, south of Butte. Samples sent to Butte for assay gave returns of $1750 per ton, and the owners claim the sample was not picked. The mine was located a few months ago by William Waugh, Charles Barnaman, C. V. Franzman, and George Chicaine. The ore was found in a vein at a depth of 50 ft. in a shaft, and has not been opened to any extent. The rich streak is 18 inches wide.

ROSSLAND, BRITISH COLUMBIA.

Increasing Gold Output.—Ore Shipments.—Granby Breaking Records.

In consequence of the increased quantity of gold in the ore shipped to the Trail smelter from the Consolidated mines here, that plant has just been enabled to ship the richest car of matte that was ever sent out of British Columbia. This car was forwarded to the Tacoma refinery and was valued at over $32,000. The matte contained 41% copper, 35 oz. silver, and 45 oz. gold per ton.——The Consolidated mines here intend to increase their output another 100 tons per day.——Development on the gold-bearing ore on the lower level of the Le Roi continues to give gratifying results.——Several more of the claims that have lain idle for years have been leased, and a number of locations on the southern edge of the ancient plug of gabbro, on which Rossland is built, which in years gone by had been allowed to lapse, have been renewed. It is doubtful whether this leasing will add to the local mining industry or not. There is little doubt that many of the leases will be thrown up after a small amount of work is done.——The following shipments were made for the week ended March 21, and for the year to date:

Centre Star	3,270	39,418
Le Roi	1,865	20,094
Le Roi No. 2	665	7,578
Evening Star	35	356
Giant-California	....	60
Total	5,835	67,506

The Granby Consolidated is still working under high pressure and surpassing records. For the week under review, ending March 21, they shipped 25,388 tons, making 219,975 for the year. The smelter treated 23,999 tons, and 215,992 for the year. On the 18th they shipped 4,048 tons, which was a record shipment. Each of the eight furnaces were treating 428 tons daily, forcing them to the very limit of capacity.——The Provincial Government will not permit the city of Greenwood to issue the $50,000 in bonds to bonus the proposed adit.——The B. C. Copper Co. has placed an order for eight 30-ton slag-pots, which will be installed before the resumption of work.——Providence 6% gold bonds to the extent of $50,000 have been placed, and work will now be resumed.——The new organization that is assuming the affairs of the Ymir mine are said to have sufficient funds on hand to do the necessary development work on that property. Funds for development is what

they have needed at Ymir right along.——Spokane men are going to dredge for gold at the confluence of the Columbia and Pend d'Oreille rivers. The company has just been organized.——An assessment of 7 c. per share will have to be levied to clear up the indebtedness of the Sullivan Mining Co. The debt is $50,000, and the outstanding bonds amount to $225,000. The assets are a smelter valued at $500,000 and the mine with 150,000 tons of ore that should carry 15% lead and 6½ oz. silver. The meeting of the minority shareholders was not held.——Shipments through Kaslo for February amounted to 935 tons, over half of which was zinc concentrate from the Whitewater Deep and Ruth mines.

YERINGTON, NEVADA.

Copper Mines. — The Bluestone. — Method of Treatment. — Mason Valley Mines. — The Nevada-Douglas. — Rockland. — Mountain View.—The Wabuska Mine.

The Bluestone Mining & Smelting Co., controlled by Capt. J. R. De Lamar, has thoroughly opened its Bluestone mine near Yerington. C. A. Weck, the manager, estimates that there are three million tons of ore available, running about 3% copper. This estimated tonnage of ore has been exposed by 8000 ft. of work, the main haulage level being a cross-cut that goes in 1200 ft., cutting through a body of ore 300 ft. wide and 500 ft. long. This level cuts the ore 300 ft. below the apex of the lode. A winze is also being sunk from this level in ore. The strike of the orebody is north, with a dip to the east. Lying west of the lode is 100 ft. of limestone, the latter being bounded on the west by granite. Before reaching the ore the main level, which was driven westerly, cuts through 600 ft. of volcanic rock. The ore is mainly a chalcopyrite, in a lime and epidote gangue, there being no oxides nor carbonates even at the outcrop. A 25-drill air-compressor is being installed at the entrance to the main adit, to be electrically driven. Mr. Weck has been experimenting for two years on methods of ore treatment and seems well satisfied with the work now being performed at the experimental plant. With crusher and rolls he pulverizes the ore to 8 mesh and then gives it a slight roast in a tower roaster to magnetize the pyrite. The roasted ore is then passed through a Wetherill magnetic separator, which takes up the mineral and discharges the waste. This product is a concentrate that will run 15% copper, which is to be smelted in the usual way. The ore is uniform in character and seems well suited to this kind of a concentration process. The fact that the epidote gangue is nearly as heavy as the pyrite would doubtless preclude successful wet concentration. While no announcement is made as to the erection of a large plant of the kind now being used on a small scale, it is to be presumed that such a plant will be built eventually.

The property of the Mason Valley Mines Co. lies to the south of the Bluestone, there being one or two intervening claims. The Mason Valley is likewise opened by adit-levels from the eastern slope of the range. The property is controlled by the Gunn-Thompson Co., of which Llewellyn Humphreys is consulting engineer, O. E. Cole being superintendent. The old workings were near the apex, but the principal base of operations now is on a 675-ft. cross-cut, which intersects an orebody 40 to 50 ft. wide in massive limestone. This ore is a heavy copper-iron sulphide in a garnetized lime gangue. A winze was sunk from this level, not on the principal orebody, but on the contact of lime and shale, and from it a cross-cut was driven into the main lode. At the entrance to the principal cross-cut is an electrically driven air-compressor and a blacksmith-shop. A cross-cut is being driven 150 ft. below this one, to cut the same lode. It is now in 200 ft. and must be driven 1000 ft. farther to cut the ore. A third cross-cut gets into ore 150 ft., at 175 ft. vertically above the main cross-cut. This and other properties in Yerington district get their power from the lines of the Truckee Power Co., whose plant on the Truckee is 95 miles distant. A great deal of work on the Mason Valley is projected for performance this year. The ore runs from 3 to 10%, much of it averaging 6% copper.——The Malachite, McConnell, and Western Nevada occupy holdings on the same copper belt as that of the Bluestone and Mason Valley, but farther south. Some work is in progress on these properties also.

The Nevada-Douglas Copper Co. owns a group of mining properties on the western slope of the Yerington range, facing Smith valley. Its holdings take in one mile of a well defined copper belt that strikes north-south, paralleling that on which the Bluestone and Mason Valley mines are located. It includes the original Nevada-Douglas and Ludwig mines. The principal vein is a quartz fissure within the limestone, but the ore also spreads into the lime, forming an irregular orebody. The vein has a dip of 45° east, which is slightly greater than that of the regular stratification. The vein-filling consists of a silicious gangue, carrying cupriferous iron pyrite and copper oxides. The oxides and carbonates extend from the surface to the 500-ft. level. The carbonates follow the dip of the main fissure, but are mostly outside of it in the limestone foot-wall, the fissure material being a gossan, carrying fair ore. Just below the 500-ft. level the sulphide ore gradually comes in, that being the water-level. Small bodies of porphyry intrude into the orebody at various points. On the contact of the lime with these porphyritic intrusions occur some of the richest shoots. In some of the oxidized stopes the ore carries 20 and 25% copper, the average being 12%. The ore in the gossan is said to average 5% copper. In the sulphide stopes are bodies of chalcopyrite, chalcocite, and bornite, running from 7 to 26%, these being in the vein proper. In the adjoining shale the pyrite assays 2% copper. The width of the ore in the sulphide portion is 50 ft. in some places. The oxidized ore in the upper levels runs from 15 to 150 ft. in width. A vertical shaft on the Ludwig has been sunk to 400 ft.; from the bottom station a 160-ft. cross-cut runs to the vein, where an air-hoist is stationed, by which a skip is operated on a 280-ft. winze that follows the dip of the vein. It is planned to raise from the head of this incline 460 ft. to the surface and make it the principal shaft for hoisting ore. At present six air-drills are operating in the mine, mostly in the sulphide orebodies. The air-compressor is at the mouth of the Douglas adit, 3500 ft. from the main shaft. This Douglas adit is in 650 ft., and when driven farther it will cut the orebody at a vertical depth of 600 ft. In driving this, thus far an 18-ft. vein of 5% copper has been intersected. W. C. Orem of Salt Lake is general manager, with S. S. Arentz as local manager. The latter states that there are 8000 ft. of work on the group. The water-supply for the property is conveyed from arteslan wells in Smith valley by a 17,000-ft. pipe-line.

The Nevada-Rockland Co., whose mine and mill are situated 26 miles south of Yerington, has not been operating the property for five months, but work may be resumed this spring, as E. A. Parberry, the superintendent, is on the ground now. The mine is well developed by adits, levels, and winzes. From the lowest level to the apex is 600 ft. vertically. The vein is 4 ft. wide, between rhyolite and diorite walls; the ore consists of chert and quartz, carrying gold. The mill was equipped for dry-crushing and cyaniding. The ore is said to average $11 per ton.

At Yerington much interest is taken in the Mountain View and contiguous properties, situated in the Walker range, which separates Mason valley from Walker lake. The Mountain View belongs to the Wilson Gold Mines Co., of Yerington. The claims are 14 miles east of this town and 6 to 8 miles from Schurz. The property covers a gold-bearing lode that strikes through the Walker range from west to east. The outcropping ore averaged $6.20 per ton, and at greater depth samples assayed from $10 to $100 per ton. Several hundred feet of work has been performed.

The Wabuska Copper Co., managed by J. E. McDermott, has 20 mining claims 16 miles from Yerington and 5 miles from Buckskin. Work at 120 ft. depth shows a 20-ft. lode of copper sulphide ore. The lode is on a contact of limestone and porphyry. The ore varies from 1 to 30% copper. The company is planning to install an air-compressor and a gasoline hoist, and then sink to water-level.

Concentrates.

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

Track-laying on standard gauge roads costs $250 to $300 per mile under fair conditions.

Cemented gravel weighs about 133 lb. per cu. ft. For large blasts, about 15 lb. of powder should be used per 1000 cu. ft. of gravel, measured in front and above the lateral drift.

Helmets such as are made for rescue service in mine fires are not trustworthy, and are good only for short periods of time. As built they are too cumbersome and hinder the vision of the wearer.

Wooden trestles for standard gauge railroad tracks cost from $9 to $10 per lin. ft. of track for trestles 15 ft. high, with 25 c. per lin. ft. for each additional foot of height, if timber costs $50 per 1000 ft. on the ground.

The horse-power transmitted by single leather belts equals the breadth in inches multiplied by the speed in feet per minute multiplied by 70 divided by 33,000. The results should be multiplied by 1.5 for double leather belts.

Electricity has found many new applications in the refining of metals. The use of the refining furnace for copper and lead is being replaced by electrolytic processes, which have done much to facilitate the recovery of small quantities of gold and silver.

In concrete work large stones may be used in many cases to economize material. These should be cleaned and laid so that no spaces are left beneath them. They prevent cracking, and are economical in engine beds and other massive foundations.

The temperature necessary for cupellation of lead buttons not containing appreciable quantities of copper or iron, is 800°C, but 850°C is necessary to start the cupellation. This temperature can be reduced to 770°C during the oxidation of the greater part of the lead.

Sand, as a mining term in use in the Lake Superior country, refers to the layers of Glacial sand that cover the deposits of iron ore in that region. Sometimes it is a quicksand and, on account of the large superficial area of the iron deposits, this sand follows the mining operations to a considerable depth.

In the treatment of asphyxiation by carbonic acid gas, fresh air is the most important agent. As soon as the first symptoms appear, the men should be brought to the surface, and if still breathing, little treatment will be necessary. If breathing is suspended, artificial respiration must be resorted to, and a few whiffs of ammonia will assist in stimulating it. Usually two or three minutes suffice to produce regular breathing. If a great deal of nausea is present, an emetic is useful. Cold bandages wrapped around the head, or bromides in the worst cases, will remove the headache which often results from the inhalation of gas.

Reliz is used among the Mexicans at El Oro as the equivalent for the hanging wall of a vein. In Sinaloa this term is applied to 'slips'; for the enclosing plane they use *tabla*. The Spanish language permits of nice distinctions: as *huellas* for tracks of hoofed animals and *rastros* for men's tracks; also *pies* for human feet and *patos* for animal's.

Igneous rocks may be classified from a chemical point of view in three ways. The ultimate composition, or the approximate units, that is, the minerals contained may form the basis for classification. Lastly, the magma may be considered a solution and the eutectic mixtures as the definite types with which the igneous rocks shall be compared.

Gravel or sand used for concrete should be free from mud and clay. It should be tested by stirring a known weight in water and finding the percentage that will settle in a limited time. Slag is often used for construction at copper smelters, and is satisfactory. Some is granulated to replace sand, and some can be crushed to replace gravel or stone.

Employment of aluminum, in quantities as low as 0.01%, to prevent blisters and fissures in steel ingots gives excellent results. Suppression of blisters is due to the fact that aluminum has so great an affinity for oxygen that when it is thrown into a crucible of melted steel it absorbs all the oxygen, free or combined with iron, disengaging such heat that the metal is extremely fluid.

The gravity stamp was invented by Von Maltitz about the year 1505, but the first commercial use of it was made by P. Gromstetter in 1519, when he established at Joachimsthal a process of wet stamping and sifting. Until the nineteenth century the stamp was merely a square timber with an iron shoe on the bottom. The discovery and development of the Comstock revolutionized milling practice.

The origin of petroleum is still open to question. It is probably the result of fractional distillation of long-buried plants and animals gradually emitted during decomposition or gentle distillation. It has also been suggested that there may be zones of metallic carbides in the earth, to which waters charged with carbonic acid and atmospheric air have penetrated. This theory is, however, in conflict with the assured physical condition of the earth's interior.

Excessive contraction of the earth's crust first doubles the strata together, then pushes the compressed fold over its side, and finally forces the crumpled mass along above the beds lying beyond the folded area, leaving older ones stranded on the later deposits. In the southern Appalachians, the overthrusts have carried the beds as much as five miles from their starting points, and subsequent erosions have destroyed any visible connection.

Discussion.

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy.

Capitalizing Equipment.

The Editor:

Sir—The report of the Mysore Gold Mining Company for the year 1907, which has just been published, contains an announcement of no little importance in connection with the system of finance adopted by John Taylor & Sons. This firm has of course always proceeded on the best possible lines of financial management and accounting laid down by leading bankers, accountants, and lawyers. The system was to charge expenditure on important new works to capital. For instance, if a new shaft was to be sunk or a new stamp-mill or cyanide plant provided, the money was not drawn from revenue, but the shareholders were asked to subscribe for new shares. Thus the capital of the Indian mines was being continually increased, and concurrently handsome dividends were being paid. For instance, a profit of a quarter of a million pounds might be distributed as dividends and at the same time the shareholders were being asked to subscribe £100,000 of new capital. I referred to this matter in another place a few years ago, and my articles were printed in 'Economics of Mining,' but it is worth while referring to the subject again. When a company is not paying its way, everything is capital expenditure, and when a company is paying to a certain extent, any additional expenditure on extensions with a view to putting the property on a sound basis is properly placed to capital expenditure. The English accountants have usually carried this principle further and held that all subsequent expenditure of this sort was rightly and logically charged to capital, although the profits were more than ample to provide the funds. Apart from the logic of the thing, the method is attractive to directors because it makes the rate of dividends look bigger. The shareholders and the stockbrokers also like it, for it makes it possible to place the capital value of the shares at a higher figure. Apparently nobody ever thinks, while the capital of the company is mounting up, that a time will come when the capital will either hang as a millstone round the neck of the company by increasing its obligations, or suddenly become extinguished by the exhaustion of the mine. A more modern school of thought has recently sprung up in many quarters (and I am here referring not to mining companies alone, but to all classes of industrial organizations), and capital commitments are discouraged wherever possible. Now, in this matter, as in others, a pound of practice is worth a ton of principles, and the stress of circumstances is often strong enough to alter principles when argument and scientific reasonings fail. Several large firms in London during the bad times of recent years, have had to find additional funds without asking the shareholders to subscribe for new shares, simply because the shareholders have not had any available money at their command. Consequently, new improvements and extensions in paying mining companies are nowadays more and more paid for out of revenue. To get back to the case of the Mysore Mine, it is specially interesting to find so eminent a firm as John Taylor & Sons adopting the modern principle. In April, 1906, the shareholders of the Mysore company were asked to subscribe for 30,000 additional shares at £6 each, leaving 3968 unissued. This result has caused the directors to decide to charge all expenditure to revenue in future. The average expenditure on capital account during the past eleven years has been about £60,000 a year, and the directors estimate that this rate is likely to be continued. Seeing that the annual profits are about £400,000 a year, this alteration in financial arrangement will not make an alarming difference in the dividend.

During the year 1907, the amount of ore milled was 194,838 long tons, producing 186,333 oz. of bullion. The cyanide plant treated 167,529 tons of tailing, producing 23,108 oz. bullion. The total extraction was 209,441 oz. bullion, equal to 210,909 oz. standard gold. The total income, after deducting £40,644 royalty, was £786,652. The costs charged to income were £357,596, and the profit was £429,056. In addition, £79,243 was spent out of the capital subscribed in 1906. The outlook at the mine is most promising, for in many places the ore is developing in large quantities, and the mine has an assured life of many years. Since 1884 the total production has been equal to £9,937,541.

EDWARD WALKER.

London, March 8.

Concerning Promoters.

The Editor:

Sir—In regard to what our Cornish friend, T. A. Arehbold, says concerning the brunt of an unsuccessful mining enterprise falling on the engineer (in your issue of March 7), I am going to differ with him.

It is the promoter that feels the jar; having worked both ends of the line, I think I am competent to speak. Who except the directors and officers know who is running the property, which is miles and miles away from the home office? When the mine shuts down, he gets a letter or two from the general manager, and he has to hunt another place. But not so with the promoter. For instance, I knew a man back East who had put on foot five different mining deals and two oil propositions; none was successful, first from one cause and then another; all over the city I would hear him spoken of as a crook, a grafter, etc. One morning I went into his office, and there was a pile of mail a foot high. I remarked on its size. Upon his request I opened a number of letters; they were all from stockholders of his unfortunate companies; some were pleading for the return of money from widows; some were formal demands "or proceedings would be instituted"; and so the letters ran. He said for years he had been getting them, and told of the distraction and worry that had been his; it was easy to see that the man had a heavier burden than he could well stand under, with no hope of the miserable load being lifted. While we were talk-

ing, a man came in, and of all the insulting remarks and names I ever heard, he gave the owner of that office, and before long I knew he had bought some stock that the promoter had offered. I was told later that once or twice a week the unfortunate man had callers like him. Such is the life of many a "cold-blooded manipulator."

To many the name of 'promoter' means crook or rascal, but that is simply because they are ignorant on the subject. One time a friend walked into my office and asked me for the definition of a promoter; my answer was: "One who gives his friends advice on some investment; if it turns out good, it is no more than right that they should have been told of it, and they in turn tell their friends of their financial genius; but if it goes wrong, they go to all their friends and brand the promoter as a liar, thief, and crook." "No," my friend said, "come to a lighter vein." Then I said: "A promoter is one who will supply the ocean if the 'easy mark' will supply the ships." "No," he said again; "A promoter is a well-dressed individual who wants to sell nothing for something to someone who wants to buy something for nothing."

TOM L. GIBSON.

Silver City, New Mexico, March 16.

Mining Law.

The Editor:

Sir—In your editorial on this subject in the issue of March 14, you say that "only in absolutely new territory, where the miner has made no entry, could a new law be applied." Is not this putting the matter too strenuously? For example, the Apex law was adopted in British Columbia, but as soon as the authorities realized the crop of lawsuits certain to ensue, they repealed this law and substituted the Square Location law. Although there have been some lawsuits over claims located under the Apex law in British Columbia, have there been any serious conflicts resulting from the application of both laws? It is probably true that the number of claims located in British Columbia under the Apex law is not great, but surely it is not too late to introduce the Square Location law into the Territory of Alaska, where the majority of claims located to date are placers.

My understanding is that we already have the Square Location law in the Philippines, and it applies the world over outside of the United States and Alaska except (?) in Rhodesia. Our placer regulations are, to all intents and purposes, the Square Location law. We now locate as placers salt, gypsum, borax, phosphate, oil, and other hydro-carbons, fire-clay, building-stone, roofing-slate, etc., and our Coal Land law is, in effect, of the same character. Moreover, in the Leadville cases, where the lodes are largely in blanket form, the Apex law was, in effect, not applied, as confusion worse confounded would have resulted from its application. Judge Lindley says, in regard to the Leadville cases and blanket veins: "It is hardly profitable to pursue the discussion further. Enough has been said to show the absurdity of the law (Apex law) when applied to geological conditions which were not in contemplation of the law-makers when the laws were enacted."

As blanket veins, folded into synclines and anticlines, and irregular orebodies and lenses, are of frequent occurrence, it is evident that the remarks of Judge Lindley may be applied to many other districts than that of Leadville.

H. W. TURNER.

San Francisco, March 24.

Amalgamation.

The Editor:

Sir—Referring to a discussion by Messrs. C. W. Van Law and E. H. Nutter in your issue of December 14, 1907, I wish to say that "large roomy mortars" are not a bit of good for catching gold that will not amalgamate, as I know from experience; in any case, modern milling does not permit of time to wait until ore is crushed in that class of mortars.

The gold I refer to here was contained in an intense black, friable tourmaline-quartz, assaying 1½ oz. gold. Only 50% of the gold freed by crushing would amalgamate; the other 50%, which was brown in color, positively would not amalgamate. I tried cyanide, also nitric acid, with like results. The gold in question was dissolved out of the tailing after a long period of treatment.

There is really no economic and handy method for the complete separation of unamalgamable gold from the pulp; traps, blanket-strakes, etc., will recover a portion of it; pan-settlers are useless, as too much concentrate gets mixed with the gold. Amalgamating-pans and tube-mills will not recover the gold, but will slime it, and in that condition it will readily dissolve in cyanide, other things being equal. A feature of interest to geologists in connection with the tourmaline vein was that as the mine became deeper the tourmaline gradually gave place to arsenical iron, copper pyrite, and native bismuth, which causes me to think that tourmaline is a secondary mineral.

D. M.

Sydney, New South Wales, January 25.

Use of a Soldering Iron.

The Editor:

Sir—Some years ago, it fell to my lot to set up a gasoline engine on a mine in Oregon that was isolated from the outside world by over 10 ft. of snow on the intervening divide. When we unpacked the battery cells, we found them all broken. Something had to be done at once. We found some pickle jars in the kitchen, which were promptly confiscated; but when we attempted to cut the tops of them off, by means of a string soaked in kerosene, igniting it and plunging the jar in water, the crack did not always follow the desired course, and we found we would be out of jars before we would have enough of them properly cut for our needs. Necessity prompted another method, which proved successful, and a description of which may be of use to some of your readers similarly situated. We invented a soldering iron, and after heating it and starting a small crack in the mouth of the jar by a gentle tap

with a small file, the point of the hot soldering iron was placed in contact with the glass about one-eighth of an inch in advance of the end of the crack, which slowly extended toward the hot soldering iron. By keeping the latter an eighth of an inch in advance of the crack, it could be led down the side of the jar to the point where it was to be cut off, when its course was changed at a right angle around the jar, and the job was done. By using this method we did not lose a single jar, and I have since used it when necessary to cut a circular plate of glass for a steam gauge, compass, or clock, always starting with a small crack in the edge of the glass. By the way, why is the above mentioned tool called a soldering iron when it is made of copper?

W. H. WASHBURN.

Ballarat, California, March 11.

[A 'soldering iron' was originally a hot iron tool, but copper is now used because the solder will alloy with the copper through the medium of a 'flux,' such as zinc chloride.—EDITOR.]

Accommodations for Employees.

The Editor:

Sir—Doubtless most of your readers are acquainted with mining camps where the men employed bring with them a roll of blankets and are assigned to a bunk-house in which are built rows and tiers of bunks and occupied by many men, allowing absolutely no privacy to the individual. As a matter of fact, a great disregard for the comfort of employees has prevailed in the majority of mining camps.

The tendency on the part of the mining companies for the last few years, however, has been to better the accommodations; as far as the writer knows, no mining company has gone to the length that the Alaska Treadwell Gold Mining Company has in providing for the comfort of its employees.

Anyone entering either of the two new rooming-houses recently completed and now occupied, would think that he was entering a first-class hotel instead of a mine bunk-house. Each building is three stories, attractively painted, with one central entrance in the front on the ground floor, and three entrances, one for each floor, in the rear of the building. You would never think that the men entering the building through the rear entrances on their way from work are the same who emerge a little later, spick and span, from the front door.

The interior of the building is divided into 26 single-bed rooms and 28 double-bed rooms, and is plastered throughout, all woodwork is painted white and the floors are oiled. The single rooms are furnished with an iron bedstead, springs and mattresses, chairs, a table, and a clothes closet. The double rooms have two beds, two clothes closets, a table, and chairs. The building is steam heated and electric lighted. Each floor is provided with porcelain lavatories, hot and cold water, and patent toilets. The very wide halls, lighted from windows at each end and from a central light-well, extend the length of the building, add much to the general appearance of the interior.

The attic is fitted up as a dry-room, and provision made so that the men can leave their dirty shoes and clothes there if they desire. Many of the men avail themselves of the large new dry-room provided with individual lockers, hot and cold water, and facilities for washing; this is situated about 50 yards from the collar of the shaft.

Opposite the main entrance of the building is a large room with chairs and tables answering as a lounging-room. This room is not used much, however, as the club is within a hundred feet, and is provided with reading-rooms, a library, billiard and pool room, bowling alleys, and baths of all kinds, and offers an ideal place for the men to spend their spare time. Each rooming-house is looked after by a janitor, who has a pass-key to each room and keeps them clean, furnishes clean towels, and sees that no malicious disfiguring of the rooms or building occurs.

The management put up these buildings believing that desirable men appreciate good accommodations, and their belief is fully confirmed by the result.

The same care bestowed upon one of the essentials to living, namely, sleeping, has been bestowed upon the other essential—eating. The boarding-house, built near the rooming-house, is a one-story building of a large floor-area and at all times presents a model of cleanliness and neatness. The table provided is the best that the market affords, and will compare favorably with any in the States.

The management takes care of its married employees by providing for them houses at a small rental; these are steam-heated and electric-lighted, and furnished with a bath and other accessories.

E. P. KENNEDY.

Treadwell, Alaska, March 13.

The longest railway tangent in the world is said to be on the line of the Buenos Aires & Pacific railway, in the Argentine Republic. The length of this is 205½ miles, and it is situated on the main line, starting at 158 miles from Buenos Aires. The straight stretch of track was formerly broken by reverse curves forming a detour around Lake Soria; the longer portion was then 175 miles long, and was even then the world's record. The lake having, however, practically dried up, the company has eliminated the curves, and the 'cut-off' was opened to service on October 15, 1907. We are informed by an official of the railway that when the line was located in the '70's (when the country was in the hands of the Indians) after leaving Junin, which was a military outpost and the last point of contact with the Buenos Aires civilization, a course of about west-northwest was set, and the line run straight across the flat 'pampas' until it met another line about 60 miles long, which was pushed out eastward from the western terminus at Villa Mercedes.

There are few industrial schemes which can stand a transplantation from their native territory without undergoing a lengthy process of assimilation and suffering considerable adjustment before evolving to a state of profitableness in a new locality.

Acid-proof cement is made by mixing powdered glass with a concentrated solution of silicate of soda.

MINE ACCOUNTS FOR THE SUPERINTENDENT

Written for the MINING AND SCIENTIFIC PRESS
By ALGERNON DEL MAR.

From time to time we have had different systems of mine accounts, more or less complicated, but very few sets of forms for the mine superintendent's use. I hope others will add or arrange the tabulations according to their own ideas, so that we may arrive at a standard set of forms that any stationer might carry in stock. We are often required to fill out forms with facts that I am sure not one director in a hundred ever looks at or could understand.

In cases where the books are kept at the home office, it were well for the superintendent to keep a set of books at the mine, and duplicates of all statements sent to the secretary of the company.

I take as an example a mine producing about 1500 tons of ore per month. There will be a mine-foreman, mill-foreman, and a cyanide-foreman, all accountable to the superintendent, who alone communicates with the home office. First consider the mine-foreman; his daily report will be very simple. Form No. 1 will cover the facts. A weekly report will cover many more facts, some of which for the first three weeks may be stated approximately, such as powder, fuse, etc., used, but they must be accurate for the full month of four weeks. Form No. 2 is submitted. He must have a time-book, like form No. 3, the letters *A* and *B* referring to the same letters on form No. 2. This may be submitted once a week at the office. The foreman, of course, has a time-check book, which can be very simple, as in form No. 4.

The mill-man will only need a daily report, like form No. 5. The tonnage crushed is generally deter-

FORM NO. 1.

NORTH POLE MINING CO.

Foreman's Statement for ..... , 1908.

Men employed underground .....
" " surface .....
Tons of ore hoisted or run out
1st class .....
2nd class .....
Tons of waste hoisted .....

REQUISITIONS.

Oil ..... Axle grease ..... Machine steel .....
Powder ..... Caps ..... Fuse .....
Candles ..... Coal oil ..... Timbers .....
.....
.....
Received
....., Foreman.

FORM NO. 4.

NORTH POLE MINING CO.

TIME CHECK.

Name .....
Time .....
Wages .....
Amount .....
Deductions .....
Net .....
....., Foreman.

FORM NO. 2.

NORTH POLE MINING COMPANY.

Foreman's Statement for Week Ending ....., 1908. No. .....

	Progress.	Men.	Total shifts.	Drilling.	Timbers.	Lagging.	Powder.	Fuse.	Caps.	Fuel.	Tons ore.	Tons waste.
A. Shaft No. 1	12 ft.	4	28	Hand	90 ft.	300 ft.	100	300	50	12 cords	12	36
B. " No. 2				$2^1/_4$ machine								
C. Heading No. 1												
D. " No. 2												
E. Raise No. 1												
F. " No. 2												
G. Winze No. 1												
H. " No. 2												
I. Stope No. 1											500	10
J. " No. 2												
K. Tramming	2 D.											
L. Timbering	4 A. P.											
M. Engine room	2											
N. Blacksmith	2											
O. Machine shop	2											
P. Miscellaneous	3											

REMARKS.

.....
.....

Total payroll $.....

..... Foreman.

FORM NO. 3.

TIME BOOK.

Month of January, 1908.

NAME.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Days.	Rate.	Board.	Where employed.
John Browne	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	31	$4.00	$31.00	Miner A
J. Smith																				1	1	1	1	1	1	1	1	1	1	1		12	5.00	12.00	Machine B
A. Adams																						1	0	0	1	1	1	1	1	1		7	3.50	7.00	" Helper B

mined from the foreman's report of ore delivered at the mill. This, as well as other items, need only be reported once a month. If the mill is a dry-crushing roller mill or of the Chilean type, the items will differ, of course, and may be added in the blank spaces. The cyanide forms will be more or less complicated, according to the particular appliances used, but most of the details of vats and solutions need not go to the office, but remain on file at the plant. Form No. 6 will cover many of the facts needed. The assay forms are not important; any statement of results will suffice.

The superintendent must now have all the facts necessary for his home reports made weekly and monthly. The weekly and monthly reports (form No. 7) may be of the same character, but need only

FORM NO. 5.

NORTH POLE MINING CO.

MILL REPORT, 1908.

BATTERY.	No. 1	No.	No. 3	No. 4	No. 5	No. 6	No.	No. 8	Total.	Remarks.
Time run	20	23	22½	22½	23	22	23½	23	179½	
Hung up (stamp hours)	20	5	7½	7½	5	10	2½	5	62½	
Broken cam, hours	2								2 hr.	
" stem "						1			1 "	
" cam shaft, "										
New shoes "	1 (2)								1 "	
New dies "										
Cam slipped "										
Shoe off "	½							½	1 "	
New screen "			¼	¼					½ "	
Mortar choked "										
Short of water "	½	½	½	½	½	½	½	½	4 "	
Cleaning plates										
Dressing "		½	¼						¾ "	
Lowering discharge				¼					¼ "	
Repairing concentrators					½	½			1 "	
Lacing belt			½	½					1 "	
Short of power										
Tappet slipped										
Changing guides										

Tons crushed
" sorted (waste)
Drops per minute
No. screen
Total ounces of mercury fed in battery
" " " " used on plates
" " " amalgam from plates
" " " " "
" " " " "
Total lb. concentrate recovered No. 1 grade
" " " " No. 2 "
Requisitions
Supplies received
Labor
Amount
Fuel

Millman.

FORM NO. 6.

NORTH POLE MINING CO.

Cyanide Plant Report, 1908.

MATERIAL.	Vat filled.	Tons.	Vat emptied.	Tons.	Hours treated.	Loss of time due to	Assay-value vat filled.	Assay-value vat emptied.	Extraction %
	No.		No.						
Sand	No.		No.						
Slime									

Tons of ore treated { Sand / Slime
Pounds of gold precipitate recovered (dry)
" " " " (coarse) returned
Assay gold precipitate
" coarse "
Weight bar bullion
Assay-value

REQUISITIONS.

Strength of solution sand
" " " slime
KCy used per ton sand
" " " " slime
Zinc " " " ore
Cost of re-grinding per ton
Labor in Cy annex
Amount wages in annex
Supplies on hand
Supplies received
Supplies used

, Cyanide Foreman.

FORM No. 7.

NORTH POLE MINING CO.

Superintendent's Report for Month Ending....., 1908.

ORE EXTRACTION.

WORKING PLACE.	No. men.	Cost labor.	Cost timbers.	Cost supplies.	Cost power.	Total cost.	No. tons extracted.	Cost per ton ore.	Av. value.	Tons waste.	Powder.	Caps.	Fuse.	Candles.	Nature of ground.
Stope No. 1.....															
" No. 2.....															
" No. 3.....															
Total.....															

DEVELOPMENT.

WORKING PLACE.	No. men.	Cost labor.	Cost timbers.	Cost supplies.	Cost power.	Total cost.	Tons ore extracted.	Width ore face.	Av. value.	Tons waste.	Total length.	Progress.	Cost per foot.	Explosives per foot.	Nature of ground.
Shaft															
Winze															
Raise															
Adit															
Total															

MILLING.

TONS OF ORE CRUSHED.	No. men.	Cost labor.	Cost timbers.	Cost supplies.	Cost power.	Total cost.	Tons shipped.	Av. value.	Conc. rec'vd.	Av. value.	Oz. amalgam.	Value.	Recovery Cy. plant.	Av. per lb.	Total av. value per ton.	Total amount from ore.

Resumé—

Ore extraction, total cost.....
Development " " .....
Milling and cyaniding, total cost.....
Superintendence and office.....
Total amount received from ore.....
" net profit boarding house.....
Credit ore not shipped.....
Profit for month.....

....., Superintendent.

FORM No. 8.

NORTH POLE MINING CO.

I herewith accept the amount set opposite my name, in full payment for work, month of....., 1908.

NAME.	Where employed.	How employed.	Days.	Rate.	Amount.	DEDUCTIONS. Board.	Miscellaneous.	Hospital.	Total deductions.	Amount check.	Signature.

FORM No. 10.

NORTH POLE MINING CO.

Supply account for month of....., 1908.

MATERIALS.	On hand 1st of month.	Bought during month.	On hand last of month.	USED DURING MONTH. Mine.	KCy plant.	Mill.	Office.	Boarding-house.
Powder.....								
Caps.....								
Fuse.....								
Candles.....								
Coal								
Coke								
Cord wood								
Fire "								
Timbers.....								
And so forth.....								

be partly filled out each week, and approximately in some details, but must be accurate for the month. The company must have all bills, a pay-sheet (form No. 8), a boarding-house account (form No. 9), and

FORM NO. 9.

NORTH POLE MINING CO.

BOARDING-HOUSE.

Month of....., 1908.

ARTICLES.	On hand first of month.	Supplies bought.	Inventory end of month.	Used during month.	Remarks.

$.....

Freight and cartage.....
Fuel.....
Cooks.....
Total.....
Wages deducted, $... per day.....
Profit or loss.....

an account of the principal supplies used during the month, as in form No. 10.

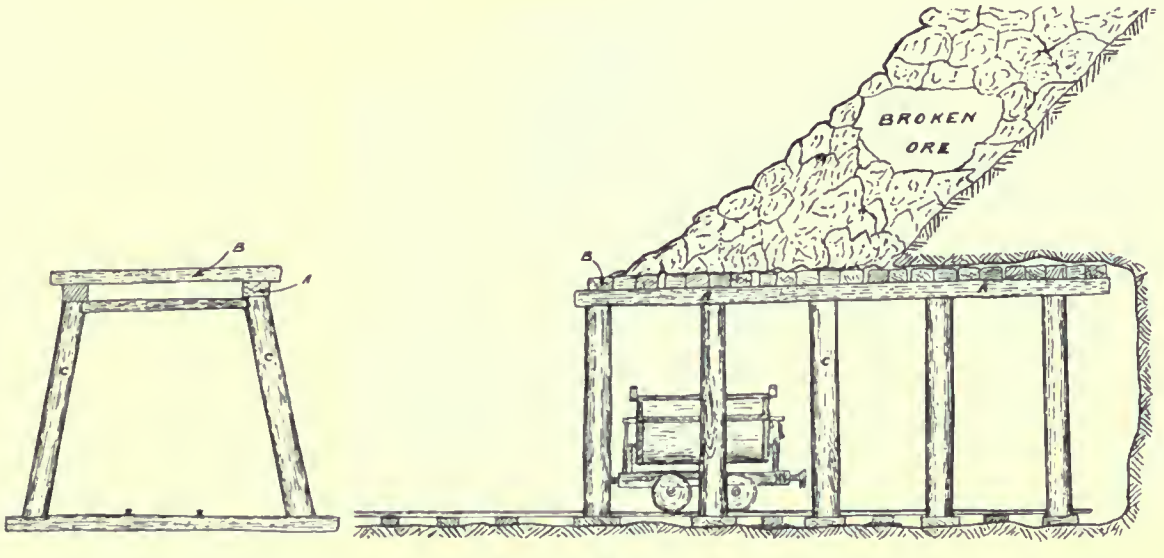
In case the office work is done at the mine, a complete copy of all transactions must go to the general office; this will include a bullion account, concentrate account, etc., which we need not consider at present.

Precipitation of Zinc From Solutions.—The United Alkali Co. has introduced a simple method of recovering zinc from liquors resulting from the wet copper process. It is a modification of the method in which the solutions are boiled with milk-of-lime. The theoretical amount of milk-of-lime is added at normal temperature, the solution being well agitated during the addition. The agitation is then stopped and the zinc precipitate as zinc hydrate is in a condition suitable for the production of zinc or its salts. For instance, if 1000 parts of liquor contain 34 parts of zinc, 30 parts of lime mixed in 500 parts of water are gradually added and the mixture agitated. As a rule, some iron is also precipitated in the ferrous state; if so, this is oxidized by exposure to the air or by suspension in water and admission of air.

METHOD OF MINING.

An economic method of quarrying rock or hard ore is shown in the accompanying diagram. Adits are driven into the hill to be quarried, the number depending on the tonnage expected and the size of the orebody. These are always kept about 50 ft. in advance of the broken ore, so as to allow space for a train of empty cars to be loaded conveniently. The adit is then heavily timbered as shown, with posts and sills.

In place of the usual transverse cap, a longitudinal stringer (A) of sawn timber, 6 by 8 in., is put on the top of the posts (C) and small stretchers are placed to keep the posts in position. Above the stringers are placed transverse pieces (B), for which railroad ties can be conveniently used, and these form the roof of the adit. Ore is then broken down on the timbers, and the cars are loaded by opening the transverse pieces with a bar. As the quarry advances, each adit will be at the bottom of a natural bunker, the sides of which are formed by the natural slope of the ore. The ore is blasted directly down



Method of Mining.

onto the top of the adit, the timbers being protected by a layer of broken ore. After a large blast the big boulders can be broken by bulldozing, and the ore need not be shoveled or handled until it falls by gravity into the cars. As the face advances and the broken ore recedes, the old timbers can be removed and again moved up to the face.

This method of mining is better than that of making a mill-hole, because there is no opening that can become blocked by large boulders, and the cost of preliminary work and equipment is reduced to a minimum. The adit should be made large and the timbering wide, so as to leave space enough for a man to load the cars, and get past them if necessary. The cost of quarrying and placing rock on cars should not exceed 10 to 15 cents per ton under favorable conditions and with a sufficient tonnage.

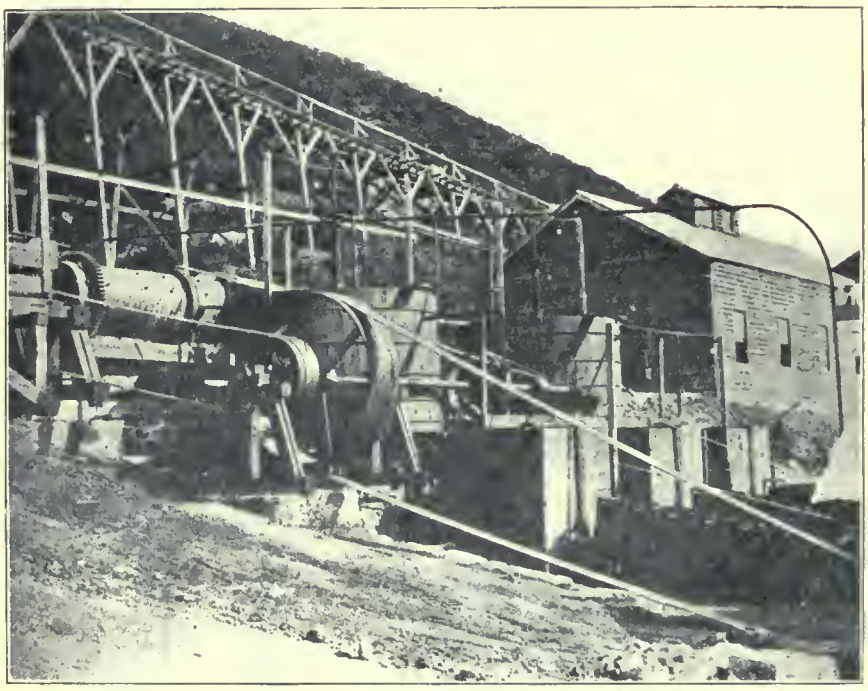
Old pick heads can often be used to make 'timber dogs.' These are always useful for framing timbers and rough carpentering.

TREATMENT OF A CONCENTRATE-SLIME.

Written for the Mining and Scientific Press
By A. E. Drucker.

A description of my vacuum-filter process as applied to heavy mineral or concentrate-slime may prove interesting, as it is quite different to other methods of filtering. I doubt whether a vacuum-filter of the Moore or Butters type will successfully treat this particular concentrate-slime, as it is not to be compared with an ordinary ore-slime. A combination of decantation and vacuum-filtering is the quickest and best method for such a product.

Very little information is obtainable from cyanide books or mining journals in regard to the cyanide treatment of concentrate. In a great many places the ore is concentrated before cyaniding and the concentrate shipped to the nearest smelter for reduction, the owners being content with high smelter charges and a (90%?) extraction. Most concentrates offer very little trouble to cyanide treatment providing the following points are observed:



Experimental Plant at Chittabalbie, Korea.

1. To be treated fresh and re-ground in a tube-mill with strong cyanide solution so that of all the product passing to an agitator at least 90% will pass a 200-mesh screen.

2. To be mechanically agitated and aerated for 15 to 20 hours within an agitator as described below.

3. The cyanide solution to test not less than 0.4% KCN when new and to test as high as 0.6% total cyanides after being in use for some time. For a short treatment of 24 hours do not attempt to cyanide with weak cyanide solutions testing only 0.15 to 0.2% and expect to get the best results. When treating a fresh clean pyrite 2 or 3 lb. lime per ton will generally be sufficient for all purposes.

4. Do not allow the strong cyanide solution to become so foul as to become inactive. This is one of the serious troubles in treating concentrate. A newly made solution free from reducing agents will give the best extraction and have the greatest dissolving power, but as it becomes older and takes up various foreign substances, which act as reducing agents, robbing the solution of its oxygen, the extraction gradually diminishes. The cheapest and most effective way of maintaining the extraction and of overcoming this reducing action is by a thorough aeration while agitating the pulp with cyanide solution. In treating concentrate it is not a bad plan to make up a new strong solution every six months.

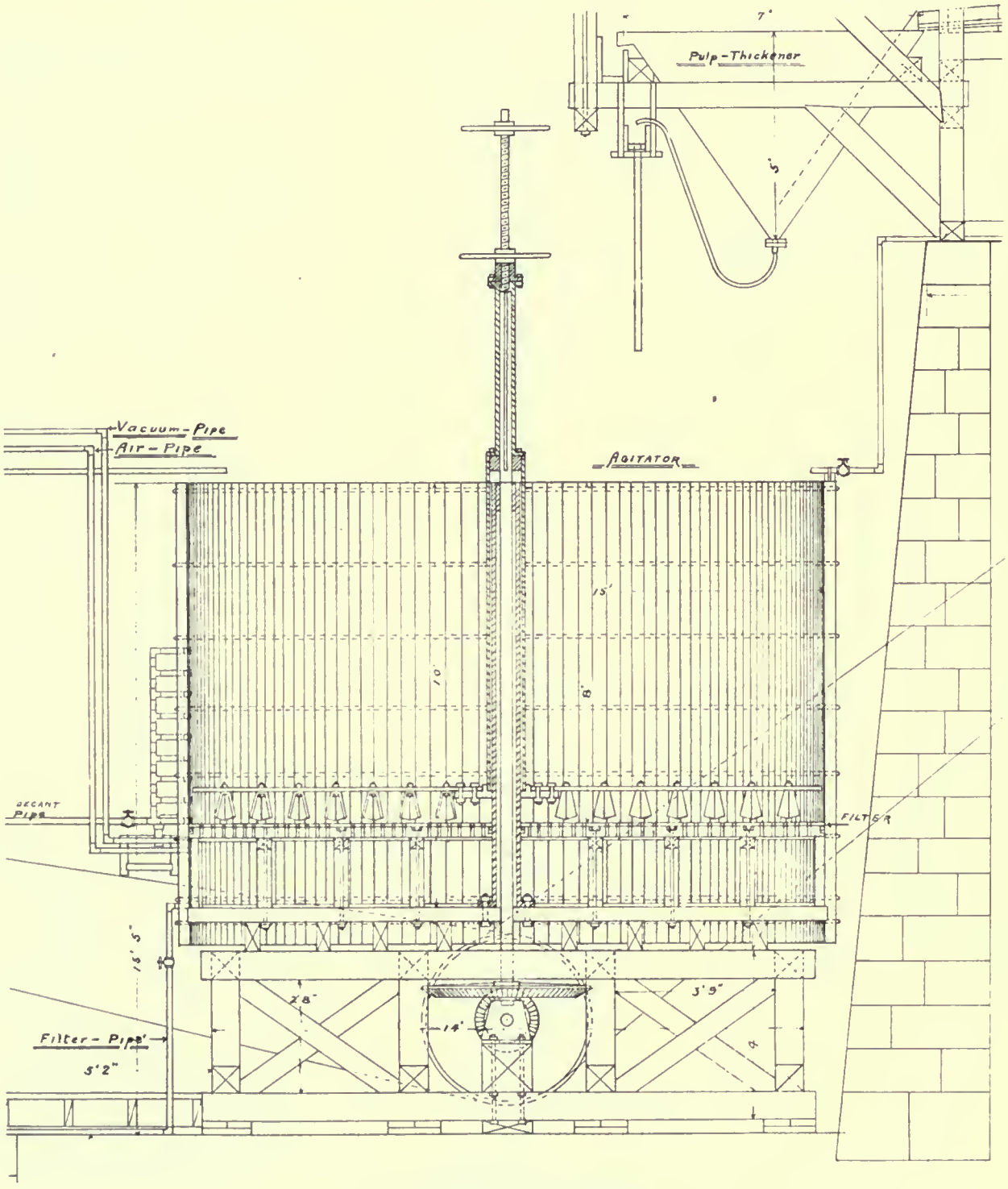
5. To rid the concentrate-slime of its gold-bearing solution the combined method of decantation and vacuum-filtering will be found to be the most efficient. A description is given below.

During the past two years I have had ample time to prove the success of this combined agitator and filter for treating a concentrate-slime at the experimental plant of the Oriental Con. Mining Co. in Korea. Before giving a description of the filter it may be well to describe in detail my method of cyanide treatment.

The concentrate when taken from the Frue vanners is practically clean; the material is conveyed to the tube-mill, mixed with a little lime, and fed to the automatic feeder with strong cyanide solution. Upon passing through the tube and being slimed in cyanide, the pulp flows to a spitzkasten, which yields two products—the underflow coarse and the overflow slime. The coarse is caught in settling-boxes and returned to the tube to be reground. Strong cyanide solution (used also in the tube) from the upper stock-vat is used for the upward sizing current in the spitzkasten. The clear overflow from the coarse settling-boxes passes to clarifying sand-filters and thence to zinc-precipitating boxes or directly to the strong sump. In order to maintain a constant pressure for the feed at the tube-mill and for sizing, a small centrifugal pump circulates the solution from the strong sump to the upper stock-vat, the overflow being conveyed back to the sump. The overflow slime from the spitzkasten (90% passes 200 mesh) flows direct to the agitator, in which a muller with plow-shoes is revolving at 15 rev. per min. The muller is lowered so that the points of the shoes are within ⅛ inch from the filter. Every charge receives from 18 to 20 hr. agitation and aeration. When aerating, air is forced beneath the filter and bubbles up throughout the charge. Everything seems to be actually boiling. Aeration and agitation are perfect at every point of the vat. After this operation is finished the agitation is stopped, the air turned off, the muller raised above the settled pulp,

and all allowed to settle for 30 minutes. With the aid of a little milk-of-lime, scattered over the surface of the solution, settling will take place within 15 or 20 minutes. Next comes the decanting of the strong cyanide-gold solution, which can be done to within 30% moisture remaining with the settled pulp. It is not necessary to wait until the solution becomes perfectly clear before decanting, since it is run into thin layer on top of the sand and is removed with a scoop every 3 or 4 days. The slime does not seem to penetrate the sand readily.

The pulp remaining within the agitator contains 30% moisture in rich gold solution and is next vacuum-filtered down to within 18% moisture. The agitator is set in motion and the muller gradually lowered through the pulp until the plows just begin to touch



Combined Agitator and Vacuum-Filter.

sand-clarifying vats and from there flows as clear as a crystal to the zinc-boxes. These clarifying-vats also serve as gold-solution storage-vats, so that the flow to the zinc-boxes can be regulated. Within each of these vats is a burlap filter four inches from the bottom and on top of each is one foot of clean coarse quartz sand. If the solution to be decanted is slightly cloudy all the slime therein will form a thin layer on top of the sand and is removed with a scoop every 3 or 4 days. The slime does not seem to penetrate the sand readily.

The pulp remaining within the agitator contains 30% moisture in rich gold solution and is next vacuum-filtered down to within 18% moisture. The agitator is set in motion and the muller gradually lowered through the pulp until the plows just begin to touch the filter. The shoes revolving next to the filter, prevent any slime-cake from forming, and when the suction is started beneath the filter, the gold-bearing solution is gradually sucked through into the compartment below. Before starting the vacuum the slime is quite thin when containing 30% moisture and agitates readily, there being no trouble in lowering the muller when plow-shaped shoes are at-

tached. I have never found any other form of shoe that will successfully work down on this heavy thick concentrate-slime, especially the last layer of slightly coarser material next to the filter which packs like cement. With a good strong suction beneath the filter the total time required to decant a solution and vacuum-filter the remaining slime down to 18% moisture is about three hours. The slime containing 18% moisture is very thick and sluggish toward the last, and it is possible to filter to 16 per cent.

After the removal of the strong solution (0.5%) there follows a 0.25% cyanide wash, assaying two to three cents per ton, which is thoroughly agitated for a few minutes, settled, decanted, and vacuum-filtered. Lastly, a weak 0.1% wash, assaying a trace in gold, is applied in the same way and upon the completion of this operation the extraction of the gold-bearing solution is practically complete. The charge is now ready to be run to waste. A little water is added, the discharge-hole opened, and the revolving of the muller will empty the agitator. A final water-wash is not necessary and consequently there are no waste solutions of any value. Both washes have their separate storage and clarifying-vats; they are run through their respective precipitation-boxes to corresponding sumps.

All details of construction of this filter will be found in the drawing. The muller has four arms at right angles to one another and to them are attached 26 cast-iron plow-shoes equally spaced. The shoes on opposite arms are arranged to work in between. The burlap filter is well braced 24 in. from the bottom and can neither bulge one way nor the other under pressure or vacuum. As a protection to the burlap one-inch boards bored with inch holes are placed on top and well spiked. The filter-cloth is between and the holes above should coincide with those below, as is shown in the drawing. The capacity of this 15-ft. agitator is 20 tons of clean pyrite-slime and it requires 5 hp. to run. The heavy pulp when once in motion at 15 rev. per min. takes very little power. The muller can be easily raised or lowered 2½ ft. During the past year I have obtained an actual extraction in bullion of 92% on a gold-bearing arseno-pyrite by the above method. This is a concentrate that gives a poor extraction (50 to 60%) by the ordinary 16-day percolation method.

An agitator of this type is particularly adapted to the treatment of a heavy sulphide slime. There is always a small amount of coarse concentrate that is bound to escape into an agitator from a spitzkasten, even though 90% of the total charge will pass a 200 screen. That part remaining on a 200-mesh, and even the coarser portion passing a 200-mesh screen, will give serious trouble to any other form of agitator, on account of being unable to work down on a cemented concentrate. There is only one form of shoe that will do it and that is the pointed plow. The charge can be settled for days and even then the muller will work itself downward through the last layer of cemented concentrate. That portion which settles compactly is nevertheless very fine and will practically all pass a 150-mesh screen.

With this arrangement a separate vacuum-filter plant is not needed. All the different operations of collecting, agitating, aerating, decanting, and vacuum-filtering are performed in the one vat, and therefore the method requires a plant of the smallest size.

ELECTRIC SIGNAL SYSTEM.

On the opposite page will be found the drawings illustrating the electric bell and flash-light signal system used in the Portland mine at Cripple Creek, Colorado. The scheme of wiring is shown in Fig. 1; the two wires leading to the dynamo are the same in each drawing, being separated for the sake of clearness. The grounding of the wires, as shown, is necessary only in case of a short circuit underground in the lighting system. The switchboard used in the mine is shown in Fig. 2; it was designed by D. C. McKeehan, the electrician to the Portland Gold Mining Co., and is made of rough lumber and ordinary porcelain insulators. The whole system exhibits three advantages:

1. By the addition of three wires, two separate systems of signaling are available.

2. The same current may be used for signaling as for lighting; batteries are unnecessary in mines that use electric lights or power underground.

3. The switchboard is of cheap construction, it is not affected by water unless entirely covered, and it is easily kept in order.

In regard to the electric plant at the Portland mine, there is a large number of motors in use, ranging from 3 to 300 hp. The current is three-phase 30-cycle alternating, as bought from the Pueblo & Suburban Co. on meter readings at the mine. One dynamo serves to operate the arc lights at surface. For this information we are indebted to Mr. F. M. Kurie, the superintendent of the mine.

The permanently frozen condition of the upper portion of the bed-rock of far northern lands is an advantage in the early stages of the development of quartz mines. On Seward Peninsula, Alaska, the ground of hillsides usually thaws in the summer to depths of 3 to 5 ft. This thawed layer is very soft and wet. The layer beneath it is thoroughly cemented by ice into a tough material exceedingly difficult to pick or break by blasting. It protects the rock beneath from the surface water, so that mine-openings are comparatively dry if the surface water is drained away from the entrance to them. The tough layer is usually only 5 to 10 ft. deep, and the material below it contains just enough ice to enable it to stand well without timbers, although it can be picked or blasted easily. Thus, broken ground or decomposed rock that in most countries would require careful timbering, on Seward Peninsula will stand for several years without any timber support. The depth to which the frozen ground extends has not been determined at many places. An adit at a tin prospect in the valley of Lost river had not reached the bottom of the frozen zone when its face was 112 ft. vertically beneath the surface.

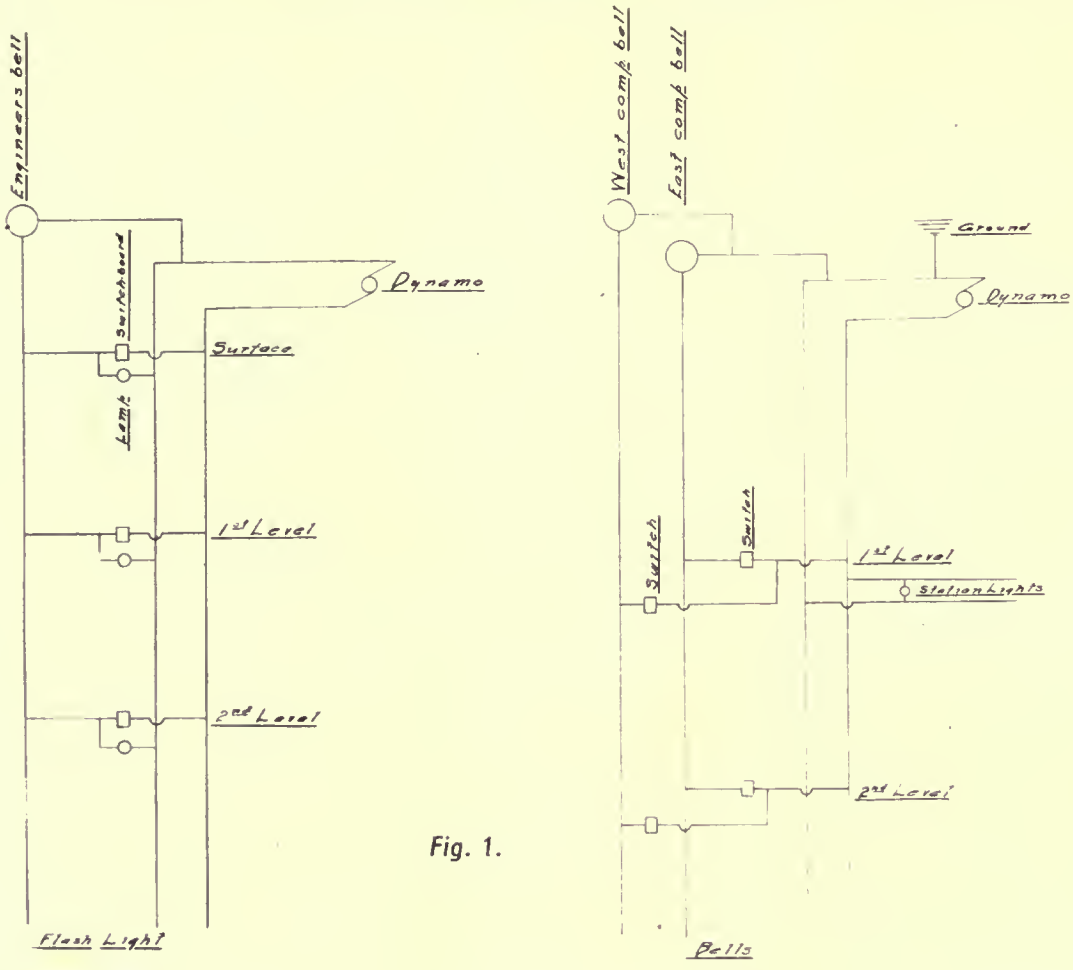


Fig. 1.

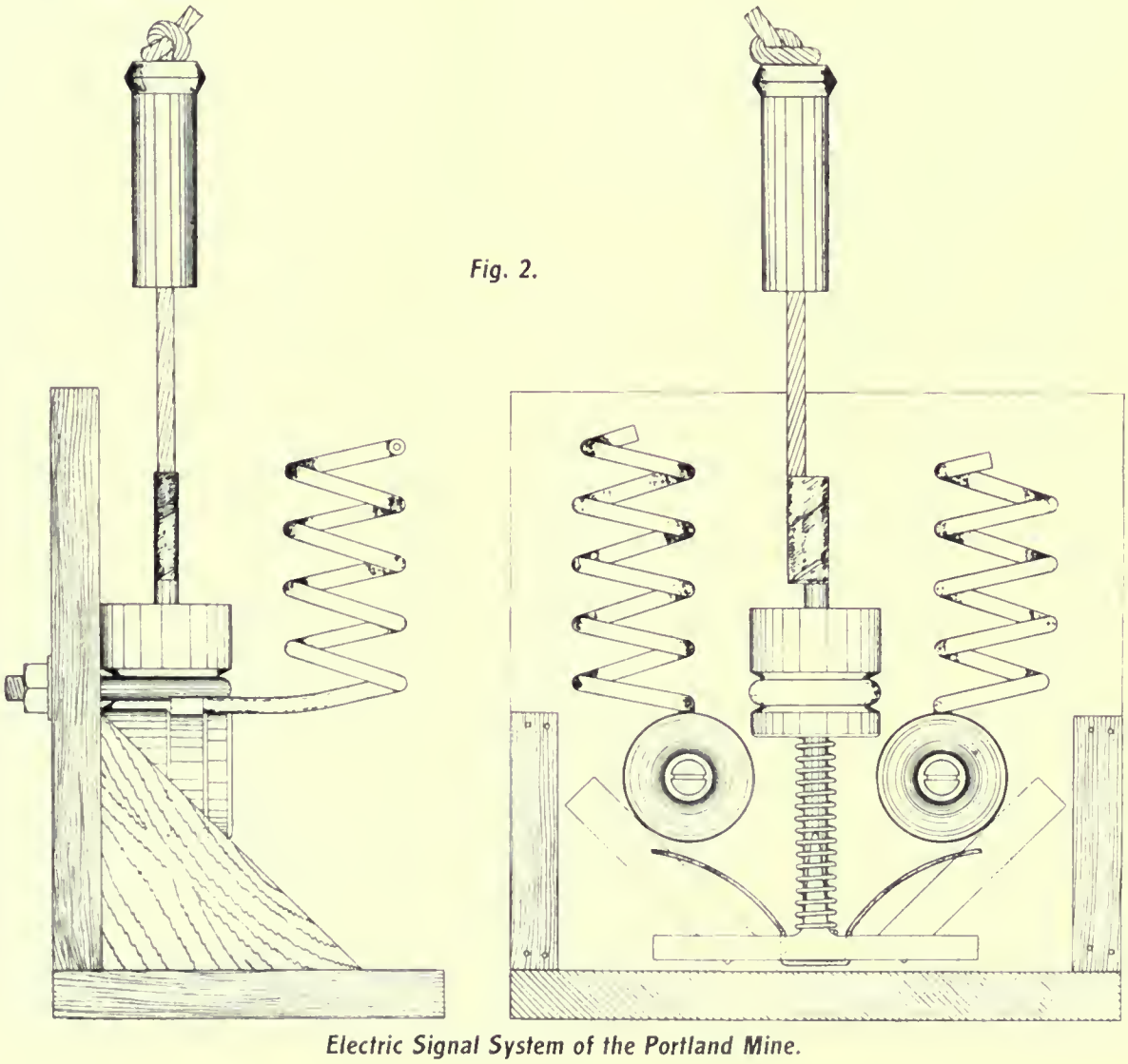


Fig. 2.

Electric Signal System of the Portland Mine.

DEVIATION OF BORE-HOLES.

By Joseph Kitchin.

*Of the 235 bore-holes that have been sunk in the Witwatersrand area of South Africa to cut the Main Reef series of lodes, 45 have reached a depth of 3000 ft. or more. The surveying of about 40 of them has shown that the deviation from the vertical may be most serious, in ascertaining the position and width of the lode as shown by the core.

The results of the surveys of 22 bore-holes were selected for tabulation. The surveying engineers have usually calculated the extent of the horizontal displacement in a straight line and not according to the varying directions the bore-holes took, and the vertical depth below the surface at the point where the lode was struck, but in cases where this point is hundreds of feet lower than that reached by the surveying instruments, the determinations are estimates only. The average deviation from the vertical is given in the following table, arranged according to the depth reached by various surveys:

NUMBER OF BORE-HOLES.

Depth Ft.	1 to 8	9 to 16	1 to 16	17 to 22	1 to 22
500	4.7°	2.5°	3.6°	8.8°	5.0°
1,000	10.6°	9.2°	9.9°	15.6°	11.4°
1,500	20.2°	19.7°	19.9°	20.2°	20.0°
2,000	24.9°	27.8°	26.4°	25.4°	26.1°
2,500	27.3°	30.1°	28.7°	.....	.....
3,000	32.9°	34.4°	33.6°	.....	.....
3,500	42.5°	.....	.....	.....	.....
4,000	47.7°	.....	.....	.....	.....

The horizontal displacement caused by the curving of the rods has varied, in the case of the bores surveyed to a depth of 4000 ft., between the minimum of 700 ft. and a maximum of 2250 ft. All the other holes tabled lie within the limits of the extremes shown by the curves of these two bore-holes. The average horizontal displacements of the 22 holes are:

NUMBER OF BORE-HOLES.

Depth Ft.	1 to 8 Ft.	9 to 16 Ft.	1 to 16 Ft.	17 to 22 Ft.	1 to 22 Ft.
500	15	10	10	35	20
1,000	85	70	75	145	95
1,500	210	190	200	290	225
2,000	400	390	395	485	420
2,500	610	635	625	.....	.....
3,000	860	910	885	.....	.....
3,500	1,150	.....	.....	.....	.....
4,000	1,485	.....	.....	.....	.....

The total depth surveyed averages 3370 ft. for the 22 bores, the average horizontal displacement being 1165 ft., and the average vertical depth below the surface at the lowest surveyed points being 3015 ft. The highest recorded angle of deviation from the vertical is 66°, noted at a depth of 4400 ft. Some of the holes first penetrated dolomite, which lies flat and is non-conformable to the underlying Witwatersrand formation. In the case of bore-holes that throughout were in the latter formation, the horizontal displacement increases, approximately, as the square of the bore-hole length. This, however, refers to the average only; the rule applies much less strictly to single holes. The flatter the dip of the strata, the greater is the deviation.

The 21 bore-holes surveyed for the direction of deviation all went northerly, although the rock formation dips in all directions. All of them deviated within an arc of 111° (from N 37° W to N 74° E), and 20 of them within an arc of 87°. The average direction is N 11° E, and the average horizontal displacement at a depth of 3000 ft. is 900 ft. A significant fact is that all of these 21 bore-holes except one deviated against the strata, that is, in a direction toward the outcrop of the formation. (Bore-holes in Western Australia also are stated to have deviated against the stratification.) It is difficult to ascertain the strike of the formation in many instances, but taking the apparent strikes, the direction of deviation relatively to the strike of the rocks is confined within an arc of 177°. Excluding three holes, which are rather exceptions to the general rule, the arc is reduced to 68°, or 46° on the one side and 22° on the other of a straight line drawn at right angles to the strike in the direction of the outcrop. The average direction taken by the 21 bore-holes makes an angle of 85° with the strike. There is a predominant tendency for a bore-hole in going down to describe a right-handed (clock-wise) curve, so that a hole which at first deviates in a northwesterly or northerly direction usually moves around to the eastward.

Of the total distance penetrated by the 22 bore-holes, 75% was in quartzite and sandstone, 9% in shale and slate, 8% in dolomite, and 8% in diabase and other igneous rock. The influence different kinds of formation have in the matter of deviation can only be judged in a rough way on account of the long intervals between the surveyed points and the absence of sufficient information as to the character of the rocks intersected. Four bore-holes that passed through practically nothing but quartzite and sandstone from the surface to depths varying from 1895 to 3000 ft. show an average deviation at 500 ft. of 5°, at 1000 ft. of 10°, at 1500 ft. of 18°, and at 2000 ft. of 25°. In another hole there is a marked increase of deviation in quartzite, the angles being 7° at 1250 ft., 19.5° at 1500 ft., and 35° at 1800 ft., though below the last the increase is not so great. In one hole the angle increased in quartzite from 38.8° at 3000 ft. to 55.7° at 3500 ft. The average increase of deviation for this class of rock is about 6° for each 500 ft. In passing to slate or shale the deviation is usually continued at the same rate of curve as above it in the quartzite, but a few cases of marked change bring the average for all the holes that penetrated these kinds of rocks to about 8° for each 500 feet.

In the dolomite formation there is a distinct contrast to the foregoing results. Eight of the 22 bore-holes were started in dolomite or entered it at a moderate depth. Their average angle of deviation in dolomite is under 1° at 500 ft. and 2° at 1000 ft. (compared with averages of 7.7° and 15°, respectively, for bore-holes not started in dolomite), while there is a marked change directly the holes penetrate the underlying Witwatersrand formation. In the case of seven other holes (not included in the 22 tabulated in this paper) there was no appreciable deviation in the dolomite, which therefore stands almost alone in permitting bore-holes to pass through it in a practically vertical direction. Igneous rock, chiefly diabase, occurs in thicknesses of 30 ft. and

*Abstracted from *Bulletin* No. 34 of the Institution of Mining & Metallurgy, London.

over, in 16 of the bore-holes. This class of rock shows the same erratic results as slate and shale, but on the average the increase in deviation angle is 6° for each 500 ft. The igneous matter has not affected the curve of the bore-holes, with three apparent exceptions. Certain holes, after going down in a practically vertical direction through dolomite, continue to be practically vertical for hundreds of feet in the underlying diabase. A bore-hole started in diabase or other igneous rock would apparently follow the example of holes started in dolomite.

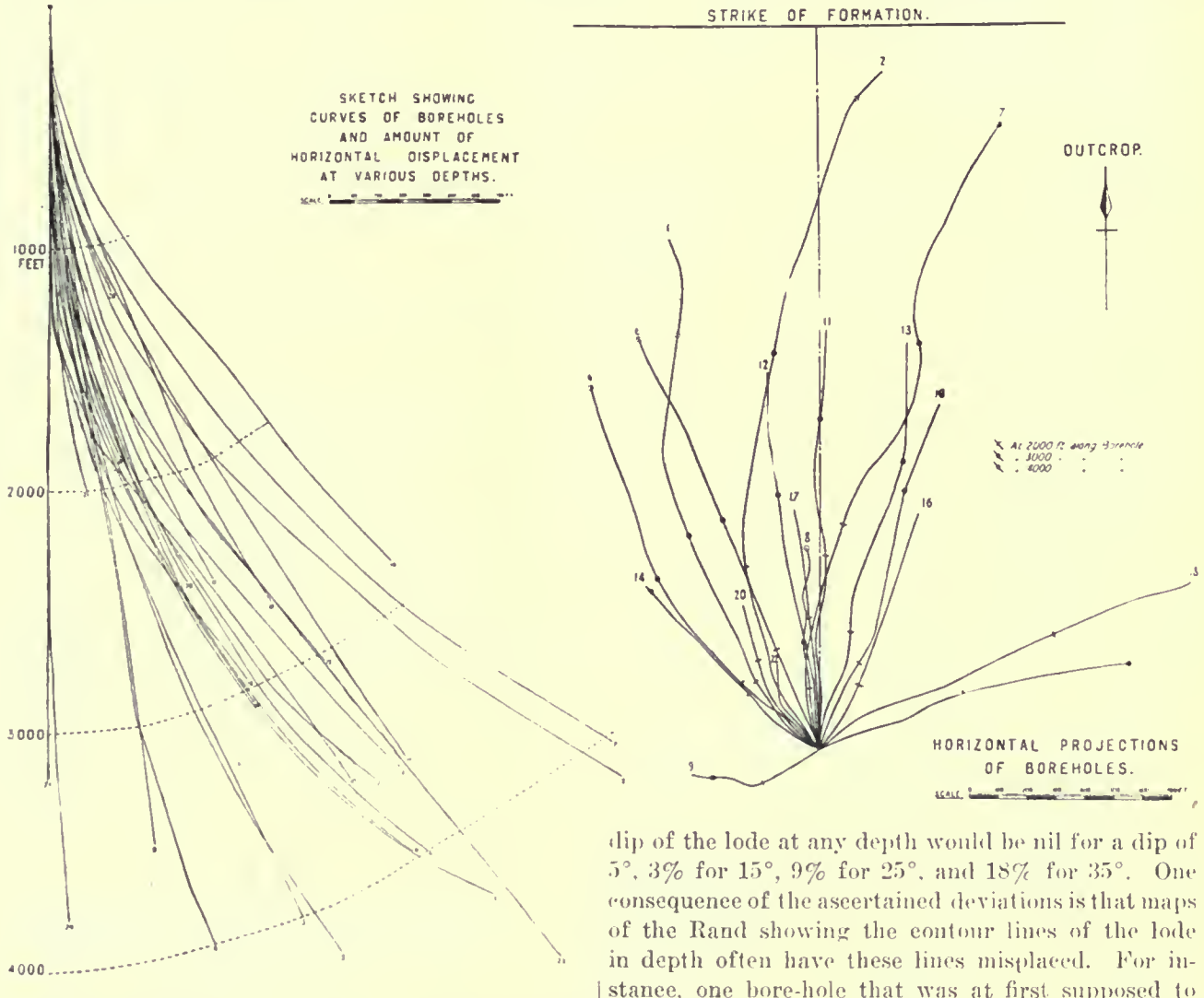
Sudden changes in the direction of deviation are noticeable in 5 bore-holes. In one there is a remarkable turn from N 96°E at 1000 ft. to N 19°E at 1250 ft.; this occurred at a point where the dolomite gave place to the Black Reef formation. In another there is a turn from N 16°W at 1400 ft. to N 14°E at 1650 ft., the only apparent cause being 7 ft. of igneous rock at 1467 ft. Other changes are accounted for by the bore-holes passing from quartzite to slate or diabase.

It is obvious that the data given by every bore-hole that intersects the Main Reef series requires to be corrected for the angle at which the hole cuts the lode-plane where it is not a right-angle. The deduction to be made from widths of ore shown by the core in order to make the necessary correction for both dip and deviation, if the bore-hole deviates directly against the strata, is indicated by the following table:

Depth of bore where it cuts the lode.	Deviation from the vertical assumed.	Dip of the Lode Formation from the horizontal.			
		5°	15°	25°	35°
Ft.		ft.	ft.	ft.	ft.
1,000	15°	1	Nil	1	6
2,000	27°	7	2	Nil	1
3,000	35°	13	6	1	Nil
4,000	50°	29	18	9	3

The correction, it will be seen, becomes especially important where the lode-depth in the bore-hole is 3000 or 4000 ft. and where the formation is nearly flat. If the bore were vertical the correction for the dip of the lode at any depth would be nil for a dip of 5°, 3% for 15°, 9% for 25°, and 18% for 35°. One consequence of the ascertained deviations is that maps of the Rand showing the contour lines of the lode in depth often have these lines misplaced. For instance, one bore-hole that was at first supposed to have struck the lode at a depth of 4419 ft. vertically under the bore-hole mouth, is now estimated to have struck it at an actual depth of 3288 ft. and vertically below a spot 2573 ft. away from the bore-hole mouth. Another consequence of the deviations is that over one-half of the bores tabled struck the lode in neighboring properties, thus largely vitiating the object of the boring.

With the aid of the results here massed one should be able to predict with a tolerable amount of probability how a bore-hole put down in the future will behave. If it were a 3000-ft. bore-hole sunk in strata of low dip, it would presumably show a horizontal displacement of between 600 and 1450 ft., with 1100 ft. as an average, and it would be likely to deviate directly against the strike of the formation, etc. With the aid of such data there



should be no reason why any future bore should cut the lode outside of the property in which it was begun.

It is perhaps easy to understand why bore-holes may deviate from the vertical, but it is difficult to ascertain why the deviations should result in the manner set forth above. The various suggestions hitherto put forward are mainly covered by the following:

1. That the deviation is due to the strata being inclined; this is rather strongly supported by the evidence, and may be said to be the general view.

2. In drilling through sedimentary strata one segment of the boring bit may be drilling in rock of different hardness from the other segment; if in softer rock the tendency will be for the bit to incline to that side, and a deflection once formed would appear to predispose to another. This is the view held by S. J. Truscott.

3. In passing into harder strata the boring bit has more work to do on the upper side of the strata, and the extra pressure consistently applied on this side gradually brings the hole to a direction at right angles to the plane of the formation. This is advocated by H. F. Marriott.

4. The first change of rock encountered in passing from softer into harder strata deflects the boring bit against the dip, and the deflection, once started, tends to increase in that direction, irrespective of further changes in the rock, as suggested by W. F. A. Thomae.

None of the above suggestions seems to account for the observed facts, though No. 4 perhaps is nearest to it. The paper was largely written in the hope of arousing a discussion among professional men.

In the discussion that followed,* J. N. Justice called attention to the fact that the longer and stronger the core-barrel, the less the tendency to deflect. He suggests that the excessive deviation may be due to needless heavy pressure upon the rods, and cites instances. W. F. A. Thomae says that while Mr. Kitchin's conclusions as to the probable behavior of future bore-holes in the Rand formations seem fairly obvious, it is doubtful whether in less regular formations the same uniformity in the behavior of drill-holes could be relied upon. He also conceives that if the drill meets a hard bar at a very acute angle there would be a tendency to force the bit in the direction of the dip, opposing the tendency to deflect against the dip as explained by Mr. Marriott.

In introducing† his paper, Mr. Kitchin cited Mr. Zboril as stating that 80 to 90% of the boring on the Rand has been effected with B rods, which are 1¾ in. diam., yielding a core of 1⅜ in. The rods and core-barrel are in 10-ft. lengths. The carbons at first protrude beyond the crown $^1/_{16}$ in., this is reduced to $^1/_{32}$ in., and then to $^1/_{64}$ in. Thus, the diameter of the bore-hole is 2⅛ in. at the top, $2^1/_{16}$ in. in the middle, and $2^1/_{32}$ in. in the lower portion. Mr. Zboril in his paper proposes, as a possible means of reducing deflections, (1) to take great care in starting the bore-hole vertically; (2) to strengthen the core-barrel, especially the shell portion; (3) to use smaller bits in the upper portion of the bore-hole to reduce the play between the core-barrel and the walls; (4) to reduce the pressure brought to bear on the lowest portion of the boring bit; and (5) to watch the rods closely for any vibrations, and stop them by stopping the drill.

Hugh F. Marriott, after explaining the method of sinking a bore-hole, said that in order to save the crown, in going through dolomite containing chert, the drill was run very light and there was no tendency to force the drill and induce a curve one way or the other: this was one of the chief reasons why in dolomite the drills kept straight. He also expressed the fear that Mr. Kitchin had attempted the impossible in formulating a set of rules to predict the behavoir of a bore-hole prior to its being sunk. As to the bore-holes all going in a northerly direction, it was merely the result of the work being carried out in southwardly dipping strata.

C. Baring Horwood corrected the statement that a 10-ft. core-barrel was usually employed; it was customary in the Transvaal to use a 20-ft. and sometimes even a 40-ft. core-barrel.

W. H. Trewartha-James attributed the initial deviation to three causes: Over-setting the diamonds; too much play between the core-barrel and the hole, or between the drill-rods and the hole; and pressure on the boring rods. When the deviation first began to make itself felt the drill sought the line of least resistance, and if this first tendency was met by a plane of harder material acting in the opposite direction, he thought the drill would be deflected back. Further, he did not think that the average of the deviations tabulated by Mr. Kitchin could be regarded as applicable in the practical work of laying out bore-holes. He suggested that holes should be surveyed while boring is in progress, and those which show abnormal deflection should be abandoned; one way to attain a more accurate hole is to increase the size of the core and the strength of the core-barrel.

Mungo Park advised the use of a long barrel. He thought it possible that magnetic attraction of the drill-rod may have been the cause of the northward deviation of the bore-holes, but it was subsequently brought out in the discussion that the lower end of the rod would probably have S-seeking polarity.

L. H. Cooke announced two principles: (1) Inclined holes tended to flatten and eventually to rise; (2) where very soft rock was encountered at an angle the rods tended to drift along the soft beds. To this Mr. Park added that a hole whose deviation is proportional to the square of its depth forms a 'conic parabola,' a curve of constant acceleration or the curve of a constant force.

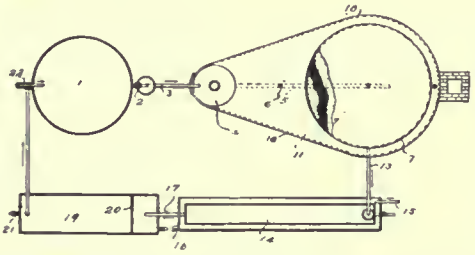
Finally, Mr. Kitchin closed his highly interesting discussion, only fragments of which are given here, by the advice to keep close to the boring point with the survey; when a hole shows a tendency to depart from the vertical, run the drill more lightly; and when the deviation becomes more serious, re-start the hole from a higher point.

* *Bulletin* No. 37 of the Institution of Mining & Metallurgy, London.
† *Bulletin* No. 39 of the Institution of Mining & Metallurgy.

MINING AND METALLURGICAL PATENTS.

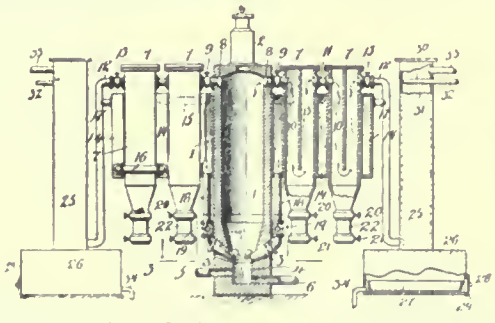
Specially Reported for the MINING AND SCIENTIFIC PRESS.

ORE-CONCENTRATOR.—No. 881,013; Ray H. Manley, San Francisco, California.



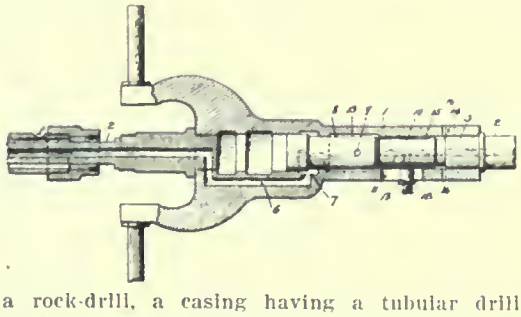
An ore-separator, comprising standards connected together at their upper ends, a cross-shaft journaled in the standards, having a cam and bevel wheel fixed thereto, a vertical shaft journaled in the connecting portion of said standards, having a head, a bevel wheel in engagement with the first-named wheel, slidably splined to the vertical shaft, a spring interposed between the last-named wheel and the head of the shaft, normally facing said head in contact with said cam, a bowl fixed to the upper end of said shaft, and an apron surrounding the upper edge of said bowl and fixed to said standards.

PROCESS OF REDUCING ARSENICAL ORES.—No. 879,932; Gustaf M. Westman, New York, New York.



The process of producing metallic arsenic consisting in subjecting arsenical ores to the action of heated reductive gases containing carbon monoxide, and then condensing the arsenical vapors passing from said ores.

ROCK-DRILL.—No. 881,059; Henry J. Cook, Ottumwa, Iowa.

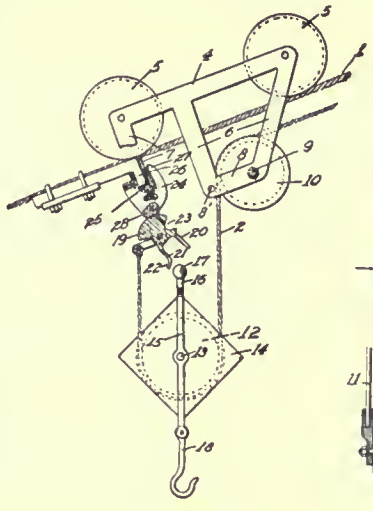


In a rock-drill, a casing having a tubular drill-stem mounted at one end, an air-propelled hammer, a striking-head mounted between the hammer and the drill-stem having a hole therein that registers with the hole in the drill-stem, and a hose connection secured to said striking-head and communicating with the hole therein, substantially as shown and described.

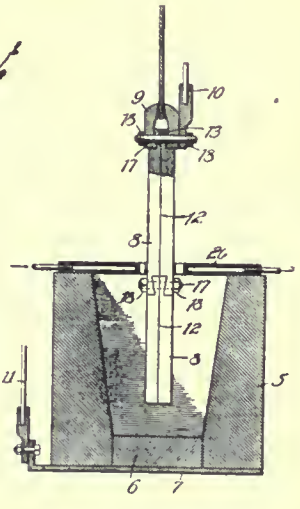
BLASTING-FUSE IGNITER.—No. 881,714. Benjamin F. Pearson, Canyonville, Oregon.

A fuse protector and igniter comprising a metal cap having a reduced or contracted outer end and adapted to be applied to the outer end of the fuse and means in the outer end of said cap whereby the fuse may be quickly ignited, substantially as described.

HOISTING AND CONVEYING APPARATUS.—No. 879,744; John W. Cooper, Seattle, Washington.



No. 879,744



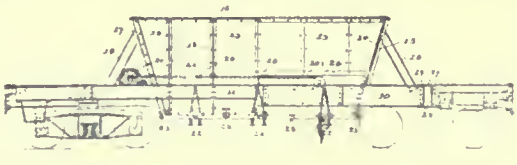
No. 881,520

In combination with a track, a carriage mounted thereon and a hoisting rope supported on said carriage, a rotatable lock element on said carriage, said element being formed with a depression, a movable catch disposed to engage in said depression when said element is rotated, a means fixed on said element and operated by said rope to rotate said element, and a projection on said rotatable element to prevent lowering of the load, said projection having a downwardly and outwardly projecting guard.

SECTIONAL ELECTRODE FOR ELECTRIC FURNACES.—No. 881,520. Charles E. Wilson, Ferris, West Virginia.

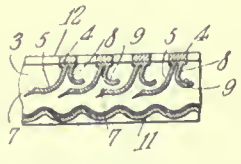
A pencil-electrode section for electric furnaces, formed of separate longitudinally extending members, fitting closely together at adjacent sides and provided at opposite ends with means for clamping the members together, and for securing the sections endwise to other sections.

METAL ORE-CAR.—No. 874,576; Ethan I. Dodds, Pullman, Illinois.



In a car of the class described, the combination with the side-sills, of a series of side-stakes secured to the inner faces of said side-sills, and a load-holding receptacle having its side-walls secured to said side-stakes, substantially as described.

ORE-SEPARATOR.—No. 881,526. James R. Yount, Nyssa, Oregon.



The combination with a sluice; of a plurality of riffles suspended therein, each riffle comprising a deflecting member and a pocket member, the deflecting member of each riffle being disposed below the pocket member of the adjoining riffle.

PROCESS OF TREATING ORES.—No. 881,101; Stanley C. C. Currie, Los Angeles, California.

The herein described process or method of extracting bismuth from ores, which consists in passing a hot caustic alkali solution through the ore containing bismuth and maintaining the heat of the ore in the solution during such passage, and finally withdrawing the solution.

CATALOGUES RECEIVED.

THE WESTERN ELECTRIC CO. have issued Bulletin No. 5910, illustrating power equipment for cement mills.

THE T. R. ALSING ENGINEERING CO. have published a booklet descriptive of the evolution of the tube-mill, and explaining their improved driving system.

VULCAN SELF-CONTAINED STEAM HOISTS for mine, quarry, or construction work are described in a leaflet forwarded by the Vulcan Iron Works, Wilkes-Barre, Pennsylvania.

THE DENVER FIRE CLAY CO. has sent Bulletin No. 19, describing the Case laboratory crusher, which is a strong and fast machine with a simple and efficient cleaning device.

THE STROMBERG-CARLSON TELEPHONE MFG. CO. has forwarded a leaflet explaining the uses of the Mine-a-phone and the economy and safeguard of a telephone installation in a mine.

THE WESTERN ELECTRIC CO. has issued its 1908-1909 catalogue. This fully describes all lines of electric supplies made by the company. The local house is at 642 Folsom St., San Francisco.

THE MORAVIA CONSTRUCTION CO., of Chicago, has issued a booklet descriptive of its standard steel suitable for manufacturing buildings, coal and ore handling apparatus, and all kinds of bridge-work.

THE BROWN HOISTING MACHINERY CO., of Cleveland, Ohio, has published a catalogue describing its grab-bucket loading cranes for handling coal and ore, and illustrating the various uses to which these machines are adapted.

THE W. S. TYLER CO., of Cleveland, Ohio, has forwarded its price list of Catalogue No. 24. This contains a number of useful tables referring to wire cloth and screen, together with a price list of trommels and all varieties of double-crimped screens.

THE WOOD DRILL WORKS has prepared for distribution its latest circular, F-4-8, explaining the simplicity and efficiency of its machines, as shown by their work on the great Zuni dam, New Mexico, which has just been completed by the Department of the Interior.

BOOKS RECEIVED.

'The Copper Handbook,' Vol. VII, has just been issued by the author, Horace J. Stevens, of Houghton, Mich. The book has 1228 pages, octavo, brevier type, being larger than before. This new edition of 'The Copper Handbook' contains 25 chapters, an increase of nine, treating of copper under the headings of History, Geology, Chemistry, Mineralogy, Mining, Milling, Concentrating, Hydrometallurgy, Pyrometallurgy, Electrometallurgy, Alloys, Brands, Grades, Uses, Substitutes, Terminology, Geography, Copper Deposits, Copper Mines, and Statistics. The treatment given the subject in 1228 pages is encyclopædic in scope, but the logical and orderly arrangement of the great mass of facts presented, coupled with a table of contents, full index and alphabetical arrangement of districts, countries, mines, minerals, and glossary, render it possible to ascertain any given fact with almost as much ease as a word is found in a dictionary. This is a point of much value to readers that has been overlooked in many otherwise excellent works of reference. 'The Copper Handbook' is not intended to replace other works for the use of technical men, but it does supplement all other technical books on copper, while for the average reader its hundreds of pages devoted to the scientific and technical features of the subject will be found to cover every point of interest. The language is plain throughout, and the layman, whether miner or investor, will find the clear and easily understandable exposition of scientific facts a great aid, as the highly technical language used in many of the best scientific works is a serious stumbling-block in the path of the man not technically trained, who is forced to read such books with a dictionary at his elbow. In whatever light 'The Copper Handbook' is viewed, whether in describing the thousands of different copper mines, in all parts of the world, in the plain descriptions of intricate processes of mining, milling, smelting, and refining, or in the forty pages of statistics covering the copper industry of the globe in its various commercial and financial aspects, the book must stand as a monument of patience and labor, it being the unaided work of a single man. The price of the book is $5, and it is for sale by the MINING AND SCIENTIFIC PRESS.

'A Text-Book of Mining Geology,' by James Park. 220 pp. Price $2.25. Published by Charles Griffin & Co., London. For sale by the MINING AND SCIENTIFIC PRESS. This handy volume is the work of the professor of mining geology in the School of Mines of the University of Otago, New Zealand. It is carefully written and adequately illustrated, with drawings and plates that are well printed. The author is a man of experience, both as an observer and a teacher, so that he knows what facts are pertinent to the subject. He is a scholar, as is suggested by the thoroughness and completeness of his references to other authors. The style is good, that is, it is suited to the purpose; it is clear and concise. We commend this volume heartily to mining engineers and economic geologists.

'Gas Power,' by F. E. Junge. Hill Publishing Co. 640 pp. Price $5. This book gives a complete scientific account of the practical achievements which have been realized in the design, construction, and application of gas-engines, producers, and power plants, up to the largest size. The book gives detailed working drawings, with descriptions for the design of all the principal parts of large gas-power machinery, and a detailed survey of the successful methods of utilizing blast-furnace gas and other cheap fuels. The latest practice of German engineers is described fully, and this is valuable because the economic conditions in Germany have developed this branch of industry to an unrivaled position.

We have received Bulletin 331 from the U. S. Geological Survey, on 'Portland Cement Mortars and Their Constituent Materials,' by R. L. Humphrey and W. Jordan.

COMMERCIAL PARAGRAPHS.

G. B. SHIPLEY, engineer of the ALLIS-CHALMERS CO.'s mining machinery department, is at Goldfield, Nev., where he, in conjunction with J. B. Fleming, for the Goldfield Con. Mines Co., is preparing the plans for the 100-stamp mill to be erected by the latter company at Goldfield, Nevada.

THE HUG WATER WHEEL CO., 1516 Blake St., Denver, Colo., has recently installed a 300-hp. Hug water-wheel, direct connected, for the Salida Light, Power & Utility Co., at Salida, Colo., and has recently received an order from the Muldoon Mining Co., Muldoon, Idaho, for a 225-hp. unit, which is being prepared for shipment.

THE A. & E. CONCENTRATOR CO., 1618 Glenarm St., Denver, Colo., has recently installed two A. & E. Slime Concentrators at the Pollock M. & M. Co.'s 20-stamp mill, Salina, Boulder county, Colo., where they are making a good saving below the plates and other concentrating tables. This machine has been thoroughly tested before it was placed on the market.

THE WEBER STEEL CONCRETE CHIMNEY CO., of Chicago, announces that, owing to increasing its field of activity in taking on other kinds of plain and reinforced concrete construction work, in addition to chimneys, it has been decided to change the name of the company, so that hereafter it will be known as THE WEBER COMPANY, general offices as before at 929-934 Marquette Bdg., Chicago.

L. Vogelstein & Co., New York, give figures of German consumption of foreign copper for the month of January, 1908:

	Tons.
Imports of copper	14,614
Exports " "	454
Consumption of copper	14,160

as compared with consumption during January, 1907, of 8332 tons.

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Editorial.

AN AMERICAN Iron and Steel Institute has been organized at New York. It is stated that the object of the organization is "to afford a means of communication between members of the iron and steel trades upon matters bearing upon their business interests. The directors include Elbert H. Gary, W. E. Corey, and Charles M. Schwab. Apparently the officials of the United States Steel Corporation are responsible for this new institute.

WE ARE GLAD to be able to announce that Mr. Courtenay De Kalb has become associate editor. Mr. De Kalb scarcely needs an introduction to our readers, and his contributions will have indicated his fitness for such work. For 15 years he has been in active professional practice, and for 7 years he served as professor of mining and metallurgy in the schools of mines of Missouri and Queens University, Canada. Mr. De Kalb will cease practice as an engineer and will devote himself exclusively to his new duties. A Virginian by birth, a New Yorker by education, and a Western American by choice, he will be warmly welcomed by the technical men resident in San Francisco and by the readers of this journal everywhere.

TWENTY-FIVE YEARS ago a million was a fabulous price for a mine. When William Letts Oliver bought the Plumas-Eureka mine, in California, for $1,000,000, in behalf of his English clients, the transaction was considered without precedent. Nowadays men talk of $50,000,000 companies and $100,000,000 consolidations as if they were boxes of cigars. An industrial concern that cost $36,000 is sold for $750,000 and the promoters make over 2000% by allowing only 4% interest on the capital and making estimates based on boom prices for their commodity. No wonder men get drunk with money-making; it is a gambling debauch, and the panic has not ended it. There are signs of a renewal of this orgie of speculation. It always ends in fortunes for the few and disaster to the many.

GEOLOGY is the friend of mining, and the geologist is the comrade of the engineer. Therefore any dissertation on the science of geology, when delivered by such an authority as Mr. James F. Kemp, is sure to be read with relish by the miner. The lecture of the Professor of Geology in Columbia University has previously appeared in the *School of Mines Quarterly*, from which we reproduce it by permission. The reprints issued by the University bear the crest of the English crown. This will remind the reader that Columbia was founded as King's College: over the gateway there used to swing a big iron crown, which now stands above the centre of

the hearth in the trustees room of the new Columbia University. The leading student club is called the King's Crown and thus serves to recall colonial times.

A GOOD EXAMPLE of newspaper science is afforded by the following description of the manufacture of portland cement, as given by a San Francisco daily paper to a correspondent at Ukiah. The seeker after knowledge is informed concerning portland cement that "it is made by mixing chalk and clay, calcining the mixture until it begins to vitrify, then grinding the clinker to a fine powder. In the process, workers employ rather different calcareous argillaceous components in proportions which experience has proved most suitable for the purpose. In amalgamating the two raw materials, in the preliminary step, the wet or dry process may be used." The technical absurdities are bad, but no worse than the misinformation given by the same paper on any subject. Just think of the people whose reading is limited to the daily press! No wonder they are easily impressed by charlatans and pseudo-reformers of every kind.

WITH REFERENCE TO the mining law, it is interesting to note that an attempt was made to adjust the rights of two friendly neighbors at El Oro, in Mexico, by an agreement based on a modified law of the apex. But it did not work. The El Oro and the Somera mines are contiguous and under the same control; in fact, the latter is a subsidiary company formed by a sale of a part of the El Oro territory. Under the agreement of sale to the Somera company, the El Oro company protected its right to follow the main lode, or San Rafael vein, in depth, notwithstanding its dip into Somera ground. It was also stipulated that any veins within the Somera property that had their apex in El Oro ground were to belong to the El Oro company. Similarly, any veins uniting with the San Rafael vein in depth, or any branches therefrom, should be deemed to be the property of the parent company. Thus the Somera was entitled only to such veins within its territory as apexed within its own boundaries. As the Chairman said: "In theory this was very simple and very nice, but the scheme broke down in practice." Several veins were cut, for there exists a whole system of embranchments, but until it was proved where a given vein apexed going up or whether it joined the San Rafael going down, it was not possible to make an accounting of the ore. The dilemma was easily overcome, and pleasantly, by an amalgamation of the two companies, so that the mining law was not illuminated, and the prospects of the mining companies were not darkened, by a lengthy litigation.

THE WELFARE of laborers in reduction works, a subject treated interestingly by Mr. L. S. Austin in another part of this issue, offers a fruitful theme for discussion. It should call forth the opinions of those who have had experience in practical endeavors for the amelioration of the conditions surrounding laboring men in their daily round of work, and especially should it draw the criticism of those chiefly interested, namely, the laboring men themselves. Care for the employee's welfare should be a purely utilitarian matter. The labor unions in a large sense represent, among other things, a protest against the benevolence of so-called reforms, which have proved ineffective because savoring too strongly of charity. Whatever lessens the self-respect of men fails to accomplish good, and the wage-earner has ever resisted becoming even in appearance an eleemosynary. Thus many well-meant efforts for bettering his condition at mining and metallurgical plants have failed, because the workman resented being coddled. Even legislative requirements touching matters of hygiene and protection against accident, which have been extensively developed in the European countries, have not satisfied the laboring people. An experienced mine manager, who had instituted numerous improvements in sanitation, and in the housing and feeding of his workmen, after witnessing the practical abandonment of the baths, the disuse of the reading rooms, the defiance of the sanitary regulations, and the denunciation of the company's boarding-house maintained on a simple cost-earning basis in order to provide clean nourishing food at small expense, gave it all up and remarked, "the working people will not let one be kind to them." It is not to be assumed that such is the truth, but rather that some defect lay in the method, and it seems to inhere in nearly all systems which have been tried. It would be interesting to learn from those most nearly concerned what it is, according to their view, that attracts or repels in the provision made by corporations for the personal comfort and convenience of employees.

Technical and Other Journals.

EFFORTS have been made to distinguish between trade, technical, and scientific journals. The last Director of the United States Geological Survey undertook to label some papers as 'scientific' and others as 'trade.' The differentiation was well meant, but unsuccessful. After all, if made sincerely, the classification is not difficult; no more difficult than the division of athletes into 'amateur' and 'professional.' The first jumps, runs, or plays ball for the love of it and accepts no payment, the latter does the same things for money or to earn an honest livelihood. A 'scientific' periodical is conducted in the interest of science and with no thought of gain; such are the quarterly journals of some scientific societies, the records of the Carnegie Institution, and the bulletins of the Survey; the managers of them accept no advertising, the cost of printing comes from the treasury of an organization of scientific men, from the Government, from Heaven it may be, or Carnegie, but in any event it does *not* come from the selling of publicity in the form of advertising space. There are some true scientific periodicals, but there are not many of them; as soon as they accept advertisements they become 'trade' papers, for advertising is as surely the mark of a trade paper as the acceptance of money is that of a professional athlete. In this sense our friends *Eco-*

nomic Geology and the *Bulletin* of the American Institute of Mining Engineers are 'trade' periodicals; but there is nothing necessarily debasing in that, and as a matter of fact certain forms of journalism, like certain sports, tend to become commercial simply because it is impracticable to conduct them without an income derived from the work. The 'technical' paper combines the characteristics of both the 'scientific' and the 'trade' publication. 'Technical' papers are those that deal with the sciences employed in manufacture and industry, their reading pages being devoted to the application of scientific methods for commercial purposes, as geology is applied to mining, chemistry to manufacturing, electricity to power and illumination, mechanics to engineering. They are a combination of the 'scientific' and the 'trade' journal, for their reading pages cannot be bought, while their advertising pages are for sale, and it is the integrity of the one that gives value to the other.

Let us narrow the discussion to a consideration of papers devoted to mining and metallurgy, for that happens to be the phase of the subject with which we are familiar, and it is well to discuss only the matters concerning which we know something at first hand. The ideal technical journal devoted to mining and metallurgy will give accurate and interesting information on these subjects without prejudice of any kind, it will not favor any machinery or other manufactured product, nor permit its reading pages to be used for the exploitation of anyone's wares, the proper place for such purposes being on the advertising pages. Ideally, the right hand should not know what the left hand doeth, the editor should not know who is advertising or likely to advertise in his paper. This may seem to many to be but an iridescent dream, and some of our experienced publisher-friends in New York will smile at such impracticable notions, for to them the reading matter is a lure for advertising, and the editor is a necessary evil, required to present a certain modicum of stuff on which to hang a profitable mass of advertising. Ideals are unattainable; when attained they cease to be ideals. We confess that the ideal technical paper does not exist nor is it likely to appear for a little while, nevertheless, a much nearer approach to it is possible if we give practical expression to our hopes, for the ideal is the terminus of hope. We can imagine a paper the reading matter of which was wholly independent of the advertiser—not mentally detached, but commercially separate. The purpose of the editor would be to give true and interesting information—interesting because true and yet made additionally attractive by the method of presentation—concerning mining and metallurgical matters, together with such comment as might emphasize their important features and stimulate the discussion of them to useful purposes; then, having an eye to a publishing business to be made profitable in an honorable way, he would select the subject-matter likely to arouse the attention of those to whom is sold the machinery advertised in the other portion of the journal. It happens that the engineers and men of business that select the machinery for mines and smelters are among the best educated and most intelligent in the modern world, so that if he, as editor, aims to interest such men, he is also likely to publish a paper useful and attractive to everyone engaged in the mining and metallurgical industries. Anything that makes the reading pages interesting to the reader, makes the advertising pages valuable to the advertiser.

A Treasure Island.

WE ARE IN RECEIPT of a letter sent to a correspondent offering him the chance to participate in great wealth suddenly. Some of our readers may be desirous of the opportunity to invest their savings in a permanent manner in a locality where "the warm Japanese current tempers the atmosphere"; for it is an island off the coast of Alaska. On this island there is a gold mine with a 5-stamp mill and in the bay close-by there are lots of ducks and geese. An engineer estimates that there is over $500,000.00 (note the unnecessary ciphers; men of imagination like to use them; they suggest more of the same kind of thing) worth of ore, which will yield $240,000.00 (again those expansive ciphers) net per annum; at least it will yield that much if it is there or, better still, if you take it from a bank and put it there. Next, "there is one ledge of gold ore near the lake that is over 100 feet wide that assays from $10 to $85 per ton in free gold." That is so obviously truthful; have we not seen many veins 100 feet wide, assaying ounces per ton, that just bobbed above the surface awaiting the pick of the deserving prospector! Moreover, a few miles inland there is a large lake and there you will find "a marvelously rich dredging proposition, the gold having been accumulating for ages in the bottom of the lake as it is washed down from the immense ledges of gold known to exist on the hills beyond." Naturally, that is the usual thing in the way of concentration of gold and that is why so many lakes are being dredged successfully today at Kalamazoo and Timbuctoo. But could not the lake have been enriched from the ledges if they had **not** been "known to exist in the hills beyond"? This is the one statement that needs explanation, otherwise the story is well founded and it ought to go far (as an air-ship) in stimulating the interest of cautious financiers. The engineer estimates that "at least one million dollars in gold net per year" can be taken out of this lake "for the next 100 years." The philanthropist connected with this enterprise is named Beer, which reminds us of the brewery that was auctioned by the great Dr. Johnson; on that historic occasion he pointed out that no common brewery was being offered for sale but "a potentiality of wealth beyond the fondest dreams of avarice." So this treasure island is no ordinary mining undertaking, it is a mineral empire surrounded by water, possessed of riches to which the glories of the Arabian nights were but the glitter of the pawnshop and to which the sheen of all the gold of Solomon was as the glimmer of the glow-worms in the pallor of the dawn. Selah.

Personal.

ROBERT R. HEDLEY is at Montreal.

D. MAIN is at Sydney, New South Wales.

T. A. RICKARD has gone on a short visit to Goldfield, Nevada.

D'ARCY WEATHERBE is in London. He intends to visit Cornwall.

CHARLES D. KEADING has returned to Goldfield from Stimler, Nevada.

ROBERT SCHORR will leave New York on the *Kaiser Wilhelm* next week.

M. L. REQUA was at Carson City for a few days and is now at Goldfield.

HORACE G. NICHOLS has returned from London to Nelson, British Columbia.

CHARLES BUTTERS left this week for Virginia City, to be gone several days.

H. G. PALSGROVE is in charge of mines at Cuatro Cienegas, in Coahuila, Mexico.

JOHN F. NEWSOM, of Stanford University, was in San Francisco this week.

J. H. CORDNER-JAMES has become a director of the Copiapo Copper Mining Co., Chile.

JAS. E. BRIENAGE is general superintendent of the Flagstaff mine, at Alta, Utah.

C. W. MERRILL is at Blair, Nevada, where his filter-press system is being installed.

GRANT D. MILLER is cyanide superintendent at Greenville, in Plumas county, California.

WILLIAM DAVEY is superintendent of mines for the A. S. & R. Co. at Velardeña, in Mexico.

A. L. GOLDIE is assistant to the superintendent of the Combination mill, at Goldfield, Nevada.

W. M. BREWER passed through San Francisco on his return from Goldfield to Victoria, B. C.

A. G. MCCRAE has been appointed assistant engineer at the Spassky copper mine, in Siberia.

H. M. THOMPSON is superintendent for the Midas Gold Mining Co., in Shasta county, California.

NORRIS ENGLISH has returned to San Francisco from the examination of mines in western Oregon.

A. M. YONGE has left Amador City to become superintendent of the Aguacate mines in Costa Rica.

S. F. HUNT is manager for the Nevada Lead Co., which is developing a mine at Hamilton, Nevada.

L. S. PIERCE, manufacturer of the Pierce amalgamator, has returned to Denver from a trip to Georgia.

W. MORTON WEBB is leaving Leadville to become manager of the May Consolidated mines in the Transvaal.

W. H. TREWARTHA-JAMES has been appointed general manager for the Tyee Copper Co. He is expected at Victoria.

CARNEY HARTLEY, who has had charge of construction work for the Colorado Dredging Co. at Breckenridge, has returned to Denver.

S. E. BRETHERTON has returned to Redding from a short visit to Boston. He is about to go to Nevada to examine mines near Goldfield.

F. L. BOSQUI is designing the cyanide plant for the 100-stamp mill of the Goldfield Con. Mines Co., and will remain at Goldfield for several weeks.

W. R. THOMAS, late of Tywarnhaile, has been appointed manager of the Botallack mine in succession to WILLIAM THOMAS, who is now resident at Camborne, acting as consulting engineer to the Allen & Meyerstein group.

ALVIN B. CARPENTER will reside at Los Angeles. The firm of Carpenter & Brennan has become Carpenter, Brennan, & Ryan, by the inclusion of EDWARD P. RYAN, recently assistant general manager for the Guanajuato Development Company.

Latest Market Reports.

LOCAL METAL PRICES—Apr. 9.

Antimony	12@16c	Quicksilver (flask)	$45@45.50
Casting Copper	14¼@15¼c	Spelter	6½@ 7¼c
Pig Lead	4.35@ 5.30c	Tin	32½@34c

ANGLO-AMERICAN SHARES.

Cabled from London.

	Apr. 2. £. s. d.	Apr. 9. £. s. d.
Camp Bird	0 14 0	0 13 0
El Oro	1 2 6	1 2 6
Esperanza	1 6 3	1 6 3
Dolores	1 5 0	1 5 0
Oroville Dredging	0 12 0	0 12 0
Stratton's Independence	0 3 3	0 3 0
Tomboy	1 8 9	1 10 0

(By courtesy of W. P. Bonbright & Co., 24 Broad St., New York.)

MINING STOCK QUOTATIONS—NEW YORK.

	Closing prices. Apr. 2.	Apr. 9.
Bingham Central	½	⅝
Boston Copper	12⅛	11⅜
Cumberland Ely	8⅜	8¼
El Rayo	1⅝	1¾
Giroux Con.	4	3¾
Guanajuato Con	2	2
Nevada Con	11⅛	11¼
Nipissing	6⅜	6½
Tennessee Copper	42⅛	42
United Copper	5¼	7
Utah Copper	29¼	30¼

(By courtesy of Hayden, Stone & Co., 25 Broad St., New York.)

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date	Electrolytic Copper	Lead	Spelter	Silver
Apr. 3	12.87	3.95	4.68	55⅛
" 4	12.87	3.95	4.70	55⅛
" 5	Sunday.	No market.		
" 6	12.87	3.95	4.70	55⅛
" 7	12.81	3.95	4.70	55
" 8	12.81	3.95	4.70	54⅞
" 9	12.81	3.95	4.70	54¾

SOUTHERN NEVADA STOCKS.

San Francisco, Apr. 9.

Atlanta	$ 25	Manhattan Con	15
Belmont	1.25	Midway	64
Columbia Mtn	21	Mizpah Extension	.....
Combination Fraction	69	Mohawk	.....
Daisy	1.37½	Montana Tonopah	1.75
Fairview Eagle	40	Nevada Hills	2.75
Florence	4.30	Rawhide Queen	2.00
Gold Bar (Bullfrog)	16	Red Top	.....
Goldfield Con	5.75	Sandstorm	36
Gold Kewanas	39	Silver Pick	21
Great Bend	74	St. Ives	29
Jim Butler	31	Tonopah Extension	1.12½
Jumbo	.....	Tonopah of Nevada	8.00
Jumbo Extension	33	Tramp Con	26
Laguna	95	West End	40

(By courtesy of W. C. Ralston, 353 Bush St.)

COPPER SHARES—BOSTON.

	Closing prices. Apr. 9.		Closing prices. Apr. 9.
Adventure	1½	Michigan	11
Ahmeek	61	Mohawk	48¼
Allouez	24¾	Nevada Con	11⅛
Amalgamated	59½	North Butte	53¼
Arcadian	3½	Old Dominion	34½
Atlantic	9½	Osceola	82
Bingham Con	¾	Parrot	18½
Boston Con	11⅜	Phœnix	50
Butte Coalition	20½	Quincy	82
Calumet & Arizona	99½	Rhode Island	3
Calumet & Hecla	629	Santa Fe	1⅝
Centennial	21½	Shannon	11¾
Con. Mercur	36	Superior & Pittsburg	12⅜
Copper Range	65¼	Tamarack	60½
Daly-West	8½	Trinity	13½
Franklin	7	United Copper com	7
Granby	90	Utah Copper	31
Greene-Cananea, ctf	8½	Victoria	3
Isle Royale	19½	Winona	5
Mass	2¾	Wolverine	125

General Mining News.

ALASKA.

(Special Correspondence).—The prospects for a big clean-up from winter work are good. The discoveries of the last few weeks of phenomenally rich pay in a number of places over the tundra give assurance of a large yield of gold-bearing gravel from Little creek, Glacier creek, McDonald creek, and Otter creek. Irene creek and Cunningham creek have come into prominence this winter, and should yield nearly half a million. The submarine beach is proving to be a uniform deposit of fair grade and great extent. The promise of a lively summer is evidenced by the big dumps of pay gravel dotting the lowlands at the back of Nome. As spring advances work is redoubled with increased energy, many operators having already begun the working of two shifts.

The census report published last year shows that in 63 factories of Alaska 2263 wage-earners received $1,365,709, or an average of over $647 each, in a period covering about six months actual labor. These factories (nearly all in the fish canning industry) earned $4,250,894 on an investment of $3,600,409. The wages for miners at Nome are $5 per day and board during the summer, and about $3.50 in winter. Mechanics in Nome and skilled workers in timbering mines and other mechanical engineering earn $1 per hour.——The North American Con. Tin Mining Co. is the title of a new organization effected in New York for the purpose of absorbing by purchase and location many of the large tracts of tin-bearing ground north of Nome. Jos. Sliscovich has begun the preliminary work for installing a 10-stamp mill with which to reduce the ore in his antimony mines on Hobson creek. All of the machinery has been shipped from San Francisco.——The Ault Fraction, lying adjacent to Little creek, five miles from Nome, is exceptionally rich. It is owned by the Pioneer Mining Co., and this winter's production of placer gold will nearly reach $2,000,000. A streak two inches in thickness on bedrock is so rich that it is carefully taken out and shipped direct to the banks for reduction without sluicing.——The Lakeview claim, at the head of Irene creek, has over 12,000 cars of pay gravel on its dump, in which gold can readily be seen with the naked eye. Over a quarter of a million will be cleaned up in the spring.——On Sunset creek the waters have been under control for nearly three months, and at least half a dozen of the operators have taken out big dumps of rich pay dirt.

Nome, March 28.

ARIZONA.

COCHISE COUNTY.

During last week the 125-ft. addition to the Copper Queen smelter was completed. The addition is now ready and the building is thus enlarged so that two more 500-ton furnaces can be accommodated whenever there is a demand for their construction. The 50-ft. addition to the power-house has also been completed and all the new machinery is now in place. This new power will be sufficient to supply any additional furnaces which may be decided upon in the future. The new ore-bin which was recently excavated alongside the original ones is now ready for the cement lining, but just when this work will be started is not known. An additional casting and elevating machine is now being installed. The machine receives the copper from the converter stands and delivers it onto the platform in bars ready for loading into the cars. The molds are arranged in a circle and are carried under the converter spouts automatically. The Queen production for the month of March was about 7,500,000 lb. copper, an increase over the product for the short month of February. During the present week the water from the artesian well in the valley west of the smelter was brought to the works, and is for the first time being used. This well was bored two years ago and a flow of 200 gal. per min. was encountered.——The Superior & Pittsburg Co.'s annual report for 1907 is issued. The company produced 9,691,405 lb. copper from ore which yielded an average of 73.84 lb. per ton, or 3.69%. During the year the company's expenses exceeded income by $1,067,640, the report showing an excess of liabilities over assets of $515,937. A total of 23,332 ft. of development work was done, and some valuable ore was developed.——Miami Copper Co. is the name of a new firm which has been floated by the Lewisohn-General Development interests. The company has a capital of $3,000,000, divided into 600,000 shares. One-half of this stock is owned by the General Development Co., which purchased and has extensively developed the Miami property. Of the treasury stock 200,000 shares will be offered to the public at $5 per share and 100,000 shares will remain unissued. The proceeds of the sale of the 200,000 shares will be used for the erection of a concentrator of

Near Prescott, Arizona.

1000 tons daily capacity.——The Miami Copper Co. has developed a large body of concentrating porphyry ore about six miles west of the Old Dominion mine at Globe. It has 2,000,000 tons of this ore in sight which averages 3% copper, and will concentrate 10 tons into 1. It is estimated that the gross cost of producing copper from this orebody will be 9c. per lb. On this basis the company would earn more than $1 per share annually on its issued stock on 13c. copper.——The Raven Mining Co. is putting in a new hoist with capacity to work to a depth of 2500 ft. While the engine was being installed some repairs were being made in the shaft. The Raven shaft is sunk on an incline down to the 1100-ft. station, which is at a vertical depth of about 800 ft. The vein opened at the 800 shows better ore than the 700. It also carries considerable silver and gold.

CALIFORNIA.

EL DORADO COUNTY.

The Gold Hill mine has been sold to N. and T. Douglas. The property is situated 12 miles from Placerville. The vein is large, but of low-grade ore, which can be cheaply treated by quarrying and milling.——At the Alpine mine, the vein has been cut on the 300-ft. level, and cross-cut for a distance of 18 ft.——A 35-hp. engine has been erected to raise water from the ditch to strip off the surface of the Green Emigrant mine. A cross-cut is being run through the ridge from the east, which should strike a rich seam about 30 ft. below the crest of the ridge.——New boxes have been put in the Pond mine at Todds valley. The old drifts will be re-timbered. The old Pond ditch, having its source in Volcano canyon, near the old Hazard mine, will be repaired.——Work will soon be resumed at several

properties on the Forest Hill divide.——The shaft at the Davenport mine, near Georgetown, will soon be sunk to the 100-ft. level by contract.——Two men are working at the Vineyard mine. An adit has been driven 170 ft., and the gravel is now harder. Work will be stopped soon unless rain comes, as water is scarce.——The shaft in the Bellevue in the Ophir mining district is down 400 ft. and cross-cuts begun.——At the Georgia mine, which lies 1½ miles north of Baker ranch, a flow of water was encountered which flooded the shaft. An adit 600 ft. long had been run from Shirt Tail canyon, which was found to be too high to drain the shaft. A branch was driven at 300 ft. from the portal to the east, and a shaft sunk 40 ft. to bedrock. This has been flooded by a stream of water on the bedrock.——About 10 men are working at the Polar Star at Dutch Flat. The cement and gravel deposit occurring here is covered by a flow of basalt.——At the Three Star shaft, near Ophir, work will be carried on at the 200 and 300 ft. levels. The pumps are being removed from the 1200-ft. level.

NEVADA COUNTY.

(Special Correspondence).—The Golden Gate mine has been re-opened. Good ore is coming from the 200-ft. level, where the vein is 18 in. wide. The property is unwatered to the 400 level, where a good body of ore was struck. N. P. Martin is superintendent.——Work continues at the Belle Union, with indications of the near proximity of the vein.——Extensive developments are going on below the 4000 level at the Central shaft.——At the Brunswick considerable ore is coming from the upper workings. The mill is running steadily.——It is reported that work will be resumed on the Sterling mine in Willow valley.——Good ore is being developed at the Delhi mine. H. Eddie is superintendent.——J. Botte has struck some deposits of promising gold ore at the Isolta ranch at Scott's Flat. The veins run from 18 in. to 20 ft. in size, and are three in number. Development will be pushed.——Work is about to commence on the new winze at the Champion mines. ——A new 16-ft. water-wheel has been installed at the Murchie mine. Extensive work is going on in the lower levels.——The Washington district is coming into prominence and much development work is going on in these mines.——Considerable driving is under way in the Magnet in good ore. The property will be opened up to considerable depth. Frank L. McPherson is superintendent.——At the Yuba developments are being pushed and large ore reserves blocked out. Twenty men are at present employed. This number will be largely increased during the spring. ——A hoist is being erected at the breast of the adit in the Mountain View. The vein has been proved for 600 ft.——A limited amount of development work is being done at the Arctic mine.——At the Marcotte mine a cross-cut adit is being driven to intersect the vein at a depth of 350 ft. Good progress is reported.——Some work is going on at the Meister group on Canyon creek.——Work is also going on at the Eagle Bird, Giant King, and several other mines in the district.

Grass Valley, April 6.

(Special Correspondence).—The management of the Idaho-Maryland mine announces that the old shaft will be re-timbered to the 1000 level and a new perpendicular shaft sunk to a depth of 1000 ft. The pay-shoot encountered on the 500 level has been uncovered over 200 ft. Considerable ore is being extracted and 20 stamps are dropping. The mine is looking better now than at any time within the past ten years. Eastern capital is behind the property. Bray Wilkins is general manager.——Cross-cutting at the Posey Canyon is opening up a large body of fair grade gravel.——Good ore has been found in several winzes at the Pennsylvania. The mill is running steadily.——Active exploration and development work is being pushed at the property recently acquired by A. D. Foote 13 miles below this city. The working force has been increased and provision made for systematic developments.——T. K. Richardson has bonded a mining claim on Bear river from J. McManus. The property contains an 8-ft. vein of fair grade ore.——Work is going on steadily at the Bear River mine. The adit is in ore of a commercial grade.——Good reserves of fair grade ore are being developed in the Union Hill. ——Work at the Belle Union is being seriously delayed by caves in the adit.——A new hoisting and pumping plant has been installed at the Ideal mine. Preparations are under way to commence immediate sinking of the shaft. The mine was formerly known as the Lincoln.——A lease has been taken by Nevada City people on a block of ground on the second level in the Mountaineer mine. Several men have been put to work.——The tramway at the Republic is being rushed to completion.——A large force of men are working at the Murchie mine and a large quantity of ore is being handled.——About 30 men were recently laid off at the Champion mine.——The Cold Springs and Buckeye properties are idle. It is reported that work will be shortly resumed.——Several men are working at the Central Consolidated. Good ore has been developed at several points. ——Considerable ore has been blocked out in the Arctic mine, with developments steadily progressing. Martin Vanberg is superintendent.——High grade ore is coming from the Mountain View mine. Several men are employed. ——Extensive prospecting is going on in the Washington district. Several of the old properties are showing well, with numerous claims giving good indications.——Arrangements for the extensive working of the Magnet mine are being made.——The labor situation in Nevada county has manifested much improvement within the past few weeks. ——Mining is unusually active throughout the Grass Valley district. Good reports come from all points.

Grass Valley, April 4.

During the year ending Dec. 31, 1907, the North Star mines produced a total value of $957,816, at a cost for current operation of $398,035, and for development of $93,020, or a total outlay for operating and development of $491,956, leaving an available profit of $445,860. Outlays during the year for improvements, $42,195, and property purchase, $344, amounting to $42,539, leaving a balance of $403,320. Interest earned during 1907 amounted to $22,760, increasing the total net earnings from all sources for the year to the sum of $426,081. Out of this there were paid dividends amounting to $250,000, 10% on the capital stock, leaving a surplus of $176,081. The above stated total was wholly produced from the North Star mine during 1907, and was obtained from 78,366 tons of ore milled, with an average yield of $11.967 per ton, at an average cost of $5.091 per ton for current operation and $1.187 per ton for development, making an aggregate cost of $6.278 and leaving a realized profit of $5.689 per ton over all costs of operation and development. Outlays during the year for improvements and property purchase amount, per ton, to $0.543, leaving a net mining profit, over all outlays, in cash surplus, of $5.146 per ton of ore. The ore tonnage produced in the past year was about 6300 tons less than in 1906, by reason of labor trouble, which interrupted productive operations during January and February, 1907. The value of the output for 1907 considerably exceeds that of any previous year. Of the above stated total, the old or upper workings of the North Star mine, on and above the 2700-ft. level, operated through the inclined shaft, produced 21,211 tons, yielding $296,798, or an average of $13.993 per ton, at an operating cost of $129,037, or $6.084 per ton, and a resulting profit of $167,761, or $7.909 per ton. The outlays for development and exploration in the old or upper mine during 1907 amounted to $35,724, or $1.684 per ton, giving a total cost of $164,762, or $7.768 per ton, and a net mining profit of $132,036, or $6.225 per ton of ore. During 1907 the deep or lower North Star mine, comprising all workings below the 2700-ft. level and operated through the Central vertical shaft, produced 57,155 tons of ore, yielding $641,018, an average of $11.215 per ton, at an operating cost of $269,898, or $4.722 per ton, and a resulting profit of $371,120, or $6.493 per ton. Additional outlays for development and prospecting work in the lower mine during 1907 amounted to $57,295, or $1.002 per ton, making for operation and development together a cost per ton of $5.724, and leaving a net mining profit of $313,824, or

$5.491 per ton of ore. The results of development and prospecting work during 1907 have been satisfactory, both in the upper and deeper levels of the mine. In the deeper levels, now the main source of production, the stopes have continued to yield a somewhat better quality of ore. The developments in the bottom of the mine are especially satisfactory. Drifts have been extended in both directions on the 4400 and 4700 ft. levels. The sinking of the inclined shaft, following the vein downward from the 4000-ft. level, at the bottom of the Central vertical shaft, was resumed Oct. 1, at a point where previous sinking had ceased, somewhat below the 4700-ft. level, and at the end of 1907 this work had reached a depth of 5000 ft. from the outcrop, measured on the dip of the vein, or 2000 ft. vertically below the overlying surface. In this work the shaft was sunk in ore for 150 ft. of its course, disclosing a vein from 3 to 6 ft. thick, of rich quartz, which now promises to be the source of much profit. The production of ore is contributed from the different levels opened in the mine, at depths varying from 1500 to 5000 ft. below the outcrop. The cyanide plants of both mills are in successful operation, treating all the mill tailing with satisfactory results. At the Central plant the cyanide process has been successfully

adapted to the treatment of the concentrate of the mills, yielding better economical results than were formerly obtained by chlorination or smelting.

At Maybert the Yuba mine has 20 to 25 men at work on development, but it is expected that the force will be doubled in about a month.——The Mountain View mine on Canyon creek is being developed under the direction of E. B. Miller, who is driving an adit on the vein at the base of the Devil's Backbone. The vein has proved continuous for 600 ft. and a power hoist is being erected at the breast to enable the continuing of the sinking of the shaft on the inner shoot. That shoot is expected to yield a bonanza. The Mountain View has a complete surface plant, and the mill is capable of crushing ten tons of quartz per day.—— A quarter of a mile farther up Canyon creek is the Arctic group, where Martin Vanberg is doing some development work. Near the top of the ridge, within sight of the Mountain View and Arctic, is the Marcotte, where a cross-cut tunnel is now being driven by contractors to tap the vein at a depth of about 350 ft. At the present rate of progress the vein is likely to be intersected within a couple of weeks. Near Ormonde on Canyon creek, half a mile above its conjunction with the Yuba river, is the Meister group, where several veins are also being opened up by Fritz Meister. At the Magnet good progress is being made in driving the drifts, and it is hoped to thoroughly explore the vein and open the orebody at some depth for overhand stoping. The Eagle Bird, Giant King, German, Old Rainbow, Star, and other mines are also working. The first freight of the season arrived in Washington last week, being supplies for the Diamond Creek gravel mine.

Good ore is being mined on the 500-ft. level of the Idaho-Maryland mine. The old shaft will soon be repaired and sinking continued from the 800-ft. level. It is reported that work will soon be resumed at the Sterling mine in Willow valley. In running the drift to the east a good vein, 18 in. wide, was found.——The Jenny Lind Mining Co. has reached the gravel in the adit at 1463 ft. from the portal, in a raise 28 ft. high. The adit will be continued for 100 ft. and breasting commenced. The blue gravel carries coarse gold.

PLUMAS COUNTY.

It is reported that a deposit of asbestos has been found near Garden Springs, 12 miles from Quincy. The property is about 400 ft. from the Western Pacific track.

TRINITY COUNTY.

The Bonanza King mine, near Trinity Center, will soon increase its force, as the debts of the company have been paid, and the dismissal of the action by the employees is being arranged. A small force of men has been at work since the failure of the California Safe Deposit & Trust Company.

SAN BERNARDINO COUNTY.

A placer deposit, rich in gold and tungsten, is reported as having been discovered near Randsburg, on the Gold Flint claim owned by A. Nixon and W. C. Wilson.

SIERRA COUNTY.

A discovery is reported in the Snow Point mine, a vein more than 4 ft. wide having been cut. The quartz is said to carry arseno-pyrite similar to that found in the Tightner mine at Alleghany, which is about four miles distant.—— At the Rainbow mine, rich ore is being milled, and a large area is now available for development above the lower adit level.——The Wyoming lode in the Deep Blue placer mine has recently been developed by the Dead River Mining Co. The vein was found 1800 ft. from the portal and some rich ore has been extracted.

COLORADO.

CLEAR CREEK COUNTY.

(Special Correspondence).—A night shift has been put on at the Capital mill, and now 70 tons of ore are being treated daily. The force in the mine is being increased daily and a heavy tonnage of smelting ore is being broken. Eight raises are being carried, all of which are up 45 ft. The shoot is still showing, measuring from 12 to 22 ft. wide. ——Extensive work is under way upon the Ramsdell mine on Lincoln Mtn. The east and west drifts are being extended and a body of heavy lead ore is being followed which measures from 18 in. to 5 ft. in thickness. This assays from $10.50 to $32 per ton in gold, silver, and lead. M. Jacoby has been appointed manager.——A compressor plant is to be installed soon at the Golden Glory adit, Saxon Mtn. The bore is now in 600 ft. J. L. Young of Empire Station is superintendent.——Heavy shipments are being maintained from the Doric holdings on Saxon Mtn. Stoping is in progress on the Magnet vein, and a streak of ore is being followed that measures from 1 to 4 ft. across. The average value of the product exceeds $100 per ton. The Magnet M. & T. Co., operating this property, will start extensive work in the near future.——Occasional shipments are being made from the Centennial, situated on Leavenworth Mtn. The adit is being extended and a streak of 4-oz. gold ore is being followed that measures from 4 to 8 in. across. David Kennedy is manager.——Connection from the Burleigh adit with the Seven-Thirty shaft will probably be made within two weeks. There remains only 50 ft. of ground to be broken before the water will be tapped. ——The Everett holdings on Republican Mtn. are undergoing systematic development. The adit has been cleaned

out and re-timbered, and now driving is being carried forward upon a streak of silver-lead ore that is from 8 to 12 in. wide.——The Lebanon group of claims is shipping ore. Maxton Bros., operating under bond and lease, are raising on a streak of ore that is from 12 to 18 in. wide, assaying $105 per ton in silver and lead.——The Smuggler continues to maintain regular shipments. Conti & Co., leasing on the fourth level, are stoping on a 2-ft. body of $90 silver-lead ore. The ground has been opened for 100 ft. and the shoot has been found to be continuous. G. A. Huffman is preparing to sink the shaft 75 ft., which will reach below the level of Clear Creek.——The Terrible is extracting both smelting and concentrating ore. Wood & Co., leasing on the 14th level, are stoping on an 18-in. streak of silver-lead ore that mills about $90 per ton. A big tonnage of milling ore is being extracted and run to the mill-bins preparatory to the starting of the machinery, about the early part of April.——Steady shipments of smelting ore are being made from the Colorado Central. The ore is being mined through the Ocean Wave or sixth level, the streak measuring from 18 in. to 2 ft. across.——M. J. Riley, leasing on the Sunburst, has discovered a new streak of 200-oz. silver ore. The find was made in carrying a raise 30 ft. above the Grant level, and the orebody measures from 2 to 2½ ft. across. The first shipment was made this week and assayed 204½ oz. silver per ton.——The Red Oak M. & M. Co. holdings have been taken under bond and lease by C. H. Poirier, representing a syndicate of St. Louis capitalists. Already work has been put under way. A raise is to be carried from the Sceptre adit to connect with the Sunburst adit, a distance of 370 ft. With this work completed all the ores from the west side of the mountain will find an outlet on the Georgetown side, thus reducing the cost of transportation to a minimum. A compressor plant is to be installed, and machine drills will be brought into use in breaking the rock. It is understood that the purchasers have made a cash payment of $25,000 upon the property, the entire purchase price to be $15,000.——Good ore has been found on the Hercules property, situated on Democrat Mtn. The owner, Robt. Fisher, is driving an adit, and a streak of $65 silver ore is being followed that measures from 8 to 12 in. wide. Stoping is under way and shipments have been started.——The Socrates workings are being cleaned out and re-timbered. It is the intention of E. Cass to drive the adit forward for the exploration of the ground.——Bryant & Co., leasing on the sixth level of the Bellevue-Hudson, still continue to send out weekly shipments of first-class ore, the net returns being $100 per ton in silver and lead. This is proving to be one of the best paying leases of recent years in the Georgetown district.

Georgetown, March 29.

A rich streak of ore has been found on a lease being operated by Butler & Co. on the Wheeling vein through the Tobin adit. The ground has been opened for a length of 100 ft. and for 70 ft. a streak of silver telluride occurs, from 4 to 6 in. wide. The stope is now 40 ft. high and the ore is being sacked.

EL PASO COUNTY.

(Special Correspondence).—During the month of March the Golden Cycle mill, which was rebuilt after the fire, treated 22,167 tons of ore from the Cripple Creek district and sampled 28,096 tons. The normal capacity of the mill will be 25,000 tons. Eight Edwards furnaces, furnished by Chisholm, Matthew & Co. of Colorado Springs, are used for roasting the ore, and five grinders and seven Chilean mills. The company has recently installed a small Jeffrey locomotive for handling coal, which reduces the force from six men to two men. A large percentage of the ore treated in this plant is custom ore. The plant was destroyed by fire shortly after they had started operation last fall, and it was necessary to remove several hundred tons of debris before work could be started on the new buildings. The mill was designed by F. Cazin of Denver and the construction work was under the supervision of C. W. MacArthur. John Tait Milliken is superintendent of the mill.

Colorado Springs, April 3.

LAKE COUNTY.

Pumping in the shaft in Iowa gulch has now reduced the water level to about 500 ft., and ten days or two weeks more will be required to drain the shaft. As soon as this is accomplished, sinking will be resumed and driving commenced.——About 60 men are now employed on the Penn property on Breece hill. Three or four sets of lessees are at work and regular shipments are being made. The Big Six, which adjoins the Penn, has also started work through the Penn No. 2 shaft, and considerable development is going on through the lower levels.

TELLER COUNTY.

A body of good ore has been developed recently at the Portland mine. The find was made between the 400 and 500 ft. levels in the Captain No. 3 stope. The deposit has been thoroughly explored and a large tonnage is blocked out. The lessees on the eastern part of the Lennox and Giddings property, on Tenderfoot hill are reported to have made a good find. The shaft is now down 200 ft.——The find that was recently made on the Mountain Beauty by the Findley Con. Co. is improving. The vein is 4 ft. wide and contains stringers of sylvanite.

IDAHO.

BLAINE COUNTY.

The discovery of a rich deposit of cinnabar is reported from the Hailey district. It is stated that an adit has been driven by J. Dacherl 720 ft. into the hill, and the last 18 or 20 ft. is said to be in rich cinnabar ore. The dimensions of the orebody have not been determined. The property is reached from Hailey by going eight miles to the Nay Aug gulch on Deer creek and about a mile to Panther gulch, and then from one-half to a mile up this gulch.

A 25-hp. electric hoist will soon be erected at the Caledonia mine. The raise to the surface, 75 ft. high, is nearly finished, and has been in ore all the way. The shaft will be 5 by 10 ft. and will be sunk from a point 60 ft. below adit No. 1. Drifts will also be run on the vein.——The oreshoot in the Gray Copper mine has increased to 3 ft. wide. The property is about 1½ miles south of Osborn, between McFarren and Myers gulch.——Good silver-lead ore has been found in the Knickerbocker group at 485 ft. from the portal. A raise has been made 8 ft. in the ore, and shows improvement.——The Coeur d'Alene concentrating plant, which is situated between Wallace and Mullan, will be started again within 60 days. The plant will be enlarged throughout and larger rolls, Wilfley tables, and Huntington mills erected. The capacity will then be about 250 tons per day.——The mill at the Thunder Mountain mine has started work. Development work has shown up some good ore. In the east drift 50 ft. of ore is exposed, and in the west drift 90 ft. has been developed. Machinery has been ordered to sink the shaft.——A large consignment of machinery has been received by the Big Sandy Co. for its elevator, at Newsome.

NEVADA.

ESMERALDA COUNTY.

The Goldfield miners' union has declared the strike at an end, allowing the men to work with non-union miners. By a vote of 90 to 25 it was decided to return to work and adopt the Tonopah scale of wages. The operators refuse any advance above their schedule, which is 50c. per day less than Tonopah, but the miners have returned to work, being glad to bring the labor difficulties to an end.

Exceptionally high grade ore is being extracted on the Little Florence. Work will be rushed to the utmost, as the lease expires on April 26. The company has other promising property which will be exploited. The Little Florence recently had to stop work on the original find, as the deposit went outside the lease onto the Rogers-Syndicate lease. Vertical side and end lines form boundaries of leases.——On the Rogers-Syndicate lease, adjoining, rich ore is being broken, and every effort is being made to hasten the work. The lease expires on July 11, and it is not probable that the lessees will have time to work out

the deposit. A shipment of 9000 lb. from this lease was purchased by the Western Ore Purchasing Co. It assayed 88.67 oz., that is, $1773.40 per ton. Shipments to the Western Ore Purchasing Co. last week were as follows: Rogers-Syndicate, 380 tons; Sandstorm dump, 116; Little Florence, 45; Combination Fraction, 57; Wakeman lease, 22 tons. The Nevada-Goldfield Reduction Works received the following shipments: Daisy, 35 tons; Jumbo, 200; New Western tailing, 158; Rogers-Syndicate, 25; American mills tailing, 35½; J. S. Cook lease, 45½; Central Ore Purchasing Co., 26; Begole Mines Syndicate, 135 tons. The Combination mill treated 630 tons of ore, worth 35 per ton.

NEW MEXICO.

SIERRA COUNTY.

(Special Correspondence).—The Good Luck mine is now operating with 30 men, doing development work. Another body of lead and silver ore was found and the outlook is encouraging. Later on they expect to erect a 100-ton mill to treat the ore from the mine. The ore runs high in lead and silver. About 900 ft. of development work has been done in ore. J. H. Elspass is manager and T. J. McKenna superintendent.

Lake Valley, April 2.

OREGON.

BAKER COUNTY.

(Special Correspondence).—Scott German, attorney for the Oregon Smelting & Refining Co., has returned to New York after conferring with W. S. Keith and the principal creditors of the company. It is stated that satisfactory arrangements for a settlement have been made with J. T. Donnelly, cashier of the First National Bank of Baker City acting as trustee for the creditors. The smelter will resume operations during the coming summer.——At the Columbia mine the new quintuplex electric pump is being installed at the 700-ft. level. For several months all mining has been confined to the levels above the 500, but now that unwatering has been continued to the 700, stoping will commence at once at this level, simultaneously with unwatering to the 900, the lowest level on the property. Since the shut-down of the Sumpter smelter the Columbia has been steadily shipping high grade ore and concentrates to the Tacoma Smelting Co. The low grade ore is being treated at the company's 20-stamp mill and cyanide plant. The mine has a large tonnage of ore blocked out, and has paid over half a million in dividends.——At the Red Boy mine a continuation of the ore-shoot of the Concord vein has been encountered on the blacksmith adit level. It is about 3 ft. in width and averages throughout a length of 80 ft., $40 in gold per ton. No stoping is being done at present, but the 40-stamp mill and cyanide plant are being put in shape for early operation.——The Eastern Oregon Mining Co. is shipping ore and concentrates to Tacoma. Their lower grade ore is being treated successfully at the company's 30-stamp mill and cyanide plant. It is reported that this company has secured control of the Sumpter smelter.——The Buffalo-Monitor mine is making regular shipments to the Baker City sampling works. The ore is high grade, shipments averaging over $100 per ton.——Greenlee & Crawford are making an exhaustive examination of the Imperial G. M. Co.'s property near Sumpter.

Baker City, April 3.

UTAH.

JUAB COUNTY.

Preparations are being made to sink the shaft of the Little Chief mine. The shaft is now down 1000 ft. and will be sunk farther, while development work is continued on the 1000-ft. level.——The May Day will resume shipments soon. A gravity tramway, connecting the May Day mine and mill has been built.——The Gemini Mining Co. has just purchased a 500-hp. electric pump. Rich ore has been developed in a winze below the 1700 level. The pump will be erected on the 1600-ft. level.——An adit is to be driven by contract, 100 ft. in length, on the Montreal group, in the eastern part of the Tintic mining district.

WASHINGTON.

OKANOGAN COUNTY.

(Special Correspondence).—The Hidden Treasure Gold Mining Co. is operating a two-stamp mill at its mine, 20 miles south of Twisp, and has made some good clean-ups during the past two months. The ore from the mine has averaged over $50 gold per ton.——A body of ore reported to be 8 ft. wide and assaying $54 per ton has been encountered in an adit on the Methow mine, at depth of 200 ft. A drift is being driven on the vein.

Loomis, April 2.

STEVENS COUNTY.

(Special Correspondence).—Ore is now being shipped from the First Thought mine to the Trail smelter, at Trail, B. C. The ore has been sent to Northport, Tacoma, and Sullivan Mines smelters. It is rumored that another new shoot of ore, richer than any previously developed, has been discovered on the 300-ft. level. A six-drill Sullivan compressor has been purchased for the mine, and an order has been placed for Sinclair and hammer drilling machines, to be used with ⅞-in. steel.——Two carloads of ore from the Seal and Queen claims shipped to the Tacoma smelter about two weeks ago asasyed 120 oz. silver per ton. A new body of silver ore has been found on the 300-ft. level of the Queen. This property is situated at Springdale.——The Scotia Mining Co. is cross-cutting from the adit on the Scotia group, on Toulon Mtn.——A new strike of gold ore has been reported from the Mountain Chief, a claim recently staked on Toulon Mtn., near the Trojan group.——The streak of high grade ore in the Railroad mine has increased to 4 ft. in width.——It is reported that a rich find has been made in the Globe mine, on Toulon Mtn.——Several mines that were producers of only silver ore are to be prospected at greater depth for copper. Among them is the Eagle mine, which 20 years ago yielded $150,000 silver.

A New Mining Camp.

Spokane, April 1.

CANADA.

ONTARIO.

During last week the City of Cobalt was added to the list of new shippers. Another car of concentrates from the Cobalt Central mines will be sent to the smelter at Sudbury this week. The stoping in the second level of the Big Pete mine has now made sufficient progress to enable the managers to supply a better class of ore to the concentrator, with the result that the yield of silver is showing a steady increase, with a corresponding gain in earnings.

MEXICO.

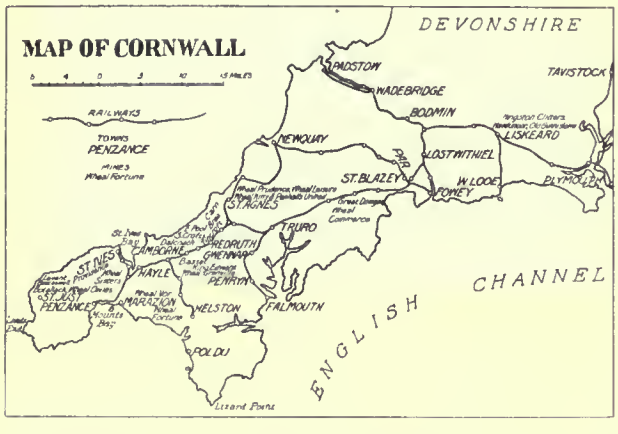
The Moctezuma Copper Co. will soon be ready to put the new concentrating mill in operation. Already some of the machinery has been given a test and it was found to be in perfect condition. In the new power-house all the machinery is in readiness. The new mill will have a stated capacity of 1500 tons per day.

Special Correspondence.

LONDON.

Treatment of Complex Ores. — Elmore Process. — Nundydroog Mine.—The Lancefield.—Hall Smelting Co. and the Le Roi.

The progress at Clitters United has received an unpleasant check and the shareholders are to be asked to put up some more money. This mine is in East Cornwall and was re-opened more than seven years ago by Messrs. Allen, Schiff, and Dietzsch, whose aspiration it was to show that by using recently discovered processes it was possible to successfully treat the complex Cornish ores which had proved unprofitable hitherto. I have frequently referred to this subject, but it is desirable again to say that the ores in question contain tin, wolfram, arsenic, and copper. The Clitters and the adjoining Hingston mine were known to be rich in these substances, and to promise a recompense to those who could separate them. The company has an issued capital of £160,000, and a debenture debt of £18,800. The dividends paid so far consist of 6¼% for 1906, and an interim dividend for 1907 amounting to 2½%, paid last July. At the time that the latter dividend was paid the prospects looked satisfactory enough, and the troubles that have since cropped up were quite unanticipated. The chief trouble has been the access of water into the lower levels of the Hingston mine, which has prevented the extraction of the richer ore as well as caused great expense in unwatering. Then the company has had difficulty in connection



with the electric pumps, which seems to be general in Cornwall. Considerable sums have been spent in this direction, and new plant is now under erection. The fall in the price of metals, as well as the lower grade of ore that has had to be worked during the last few months, since the better ore has been under water, have affected the profits, and the directors feel bound, in order to put the company in a sound financial position once more, to ask for more capital. They therefore propose to issue 160,000 new priority shares of five shillings each, to be offered to shareholders pro rata. There is no doubt that shareholders will respond.

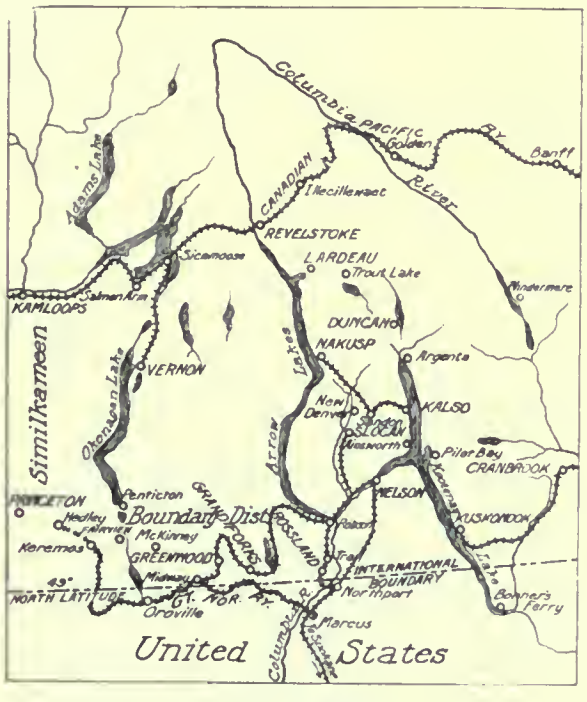
It is of interest to give some particulars of the work done at Clitters during the year 1907. The ore treated was 20,634 tons and the recovered concentrates were as follows: Tin concentrate, 122 tons, valued at £13,678; wolfram, 62¼ tons, value £8614; refined arsenic, 242 tons, value £6883; and copper residues, 180 tons, value £581. The satisfactory state of the arsenic trade has induced the directors to buy ores from neighboring dumps, such as those at the now abandoned Great Devons Consols mine, and negotiations are in progress for the acquisition of 30,000 tons of this material. It is intended to erect a modern arsenic refinery specially designed by T. C. Cloud. There is some intention also of purchasing complex ores from other mines for treatment by magnetic separation. The directors state that the Elmore vacuum plant recently erected has not so far proved a success. I would respectfully suggest that the process is not likely to succeed in the way it is now being used. In fact there is no object in using it at all unless it is used in the way the inventor intends. As it is, the directors are using it in such a way as to reduce the royalty to a minimum and not with a view of the highest recovery. My own experience with the plant shows that it should be used to remove the pyrites from the tin and wolfram. This means that the whole of the ore should go direct from the stamps through the vacuum plant. Consequently the whole output would be subject to the inventor's royalty. In order to prevent this, the separation of the pyrites is done as far as possible on tables, and only the secondary products go to the vacuum chamber. In this way the royalty is reduced, but the expenses are increased, and the methods of separation duplicated, besides considerable losses incurred in the water concentration.

The Nundydroog mine, one of the Mysore group of mines managed by John Taylor & Sons, continues to open up well, and is in as satisfactory a condition as at any time during its twenty-five years of life. Mr. Thomas Richards, a good Cornishman, has been manager for more years than I can remember, and his knowledge and opinions of Mysore mines are unrivalled. His view of the developments at the 2000 to 2300 ft. levels is that the probabilities of a plentiful supply of ores are very encouraging. During the year 1907 the reserves increased considerably, and are approximately eighteen months ahead of the mill. The production of gold for 1907 was 74,964 bullion ounces, valued at £283,138. Of this amount 66,696 oz. were obtained in the stamp battery from 84,000 long tons of ore, and 8268 oz. were obtained from 83,970 tons of tailing. The net profit was £128,749, of which £99,050 has been distributed as dividends and £18,000 applied to capital expenditure. The total production of gold since 1882 is 773,767 standard ounces, valued at £3,015,711. The first few years did not produce much gold, and it was only in 1888 that the returns were in any way substantial, the yield of that year being 6728 standard ounces from 3887 tons of ore. Since then the amount of ore treated and the yield have gradually increased and the increase has been steady except during the years 1898 and 1899, when there was a temporary decrease in the output. As with the Mysore Company, referred to last week, so it is to be in the future with this company with regard to the outlay on new capital expenditure. Instead of issuing new shares whenever new special expenditure is embarked on, the directors intend in future to depend entirely on the profits. Hence we see the item of £18,000 mentioned above. The dividends for the four previous years were over the £100,000 mark, but in those years nothing was put by for capital expenditure. Another new departure in connection with the finance of the mine that is of considerable interest is that in future a certain portion of the profit in each year is to be set aside for distribution in the form of a bonus among the directors, managers, and staff in India and London.

It has been decided by the shareholders of the Lancefield Gold Mining Co. to agree to an assessment of two shillings a share in order to provide additional plant. The Lancefield mine is situated in the Mount Margaret goldfield of West Australia, and the company was floated in London over three years ago by Bewick, Moreing & Co. The property consists of large deposits of what is known in West Australia as low-grade ore, running $8 to $10 per ton. When the orebodies were opened out they did not appear to present any metallurgical difficulties, being oxidized ores at the surface and sulphides below. A 50-stamp mill and a cyanide plant were erected, and at first all went well. It was found, however, that the ore was more difficult of treatment than was expected, and as developments went on the ore became more refractory. It was considered best therefore to alter the system of treatment, and a system of dry-crushing, roasting, and filter-pressing was adopted. The new plant was designed to treat 9000 to 10,000 tons a month and there was no reason to suppose that the extraction and profit per ton would be much different from those at Great Fingall or Sons of Gwalia. A 30s. extraction was figured on, with total expenses of 21s., which would have meant a very good profit. A second unanticipated difficulty was now met with, for the ore proved more troublesome than at the other mines, and the time occupied in treatment was so

much longer that the plant can only deal with 5000 to 6000 tons a month. For one thing, the presence of arsenic in the pyrites makes the roasting more tedious, and secondly the ore is so hard that the capacity of the grinding mills is considerably reduced. The cost of treatment is considerably higher and the profit nearly extinguished. The only plan for reducing costs was to increase the output, and for this purpose the directors proposed to build additional plant. Efforts were made to provide for this plant without having to approach shareholders, but this was impossible. It is hoped that by the expenditure on this additional plant, by which the output will be increased to 10,000 tons a month, the costs of treatment will be reduced to 23 or 24 shillings. If the extraction is 30s., a very fair margin of profit will be left.

The official account of the collapse of the Hall Mining & Smelting Co., operating at Nelson, B. C., has just been published. The directors are very severe on Robert R. Hedley, who was smelter manager up to a year ago. They state that he did not understand the working of the Huntington-Heberlein process, which was started in the autumn of



British Columbia.

1906, and that consequently he made the cost of smelting lead ores three dollars more than before. They also accuse him of over-estimating the contents of the stock of ore on hand, and of passing more ore through the furnaces for every ton of metal extracted than he showed in his returns. This state of things caused the banks to stop the loans, so that the buying of ores had to be suspended. All the ore on hand was smelted in the hope of saving the financial position of the company, and attempts were made to issue prior lien bonds, but without avail. There was nothing for it but for the debenture-holders to step in and take possession. Negotiations are now being conducted with a view to leasing the smelter and the mines. It is doubtful, however, whether anything can be done during the present depression.——The Josie mine, belonging to the Le Roi No. 2, continues to produce ore and is now looking better than ever. Four years ago Messrs. Alexander Hill & Stewart, in taking over the management of affairs, considered that there was a possibility of the mine lasting eighteen months. Since then, owing to careful exploration work, many additional veins, passed over by previous owners, or discovered at first hand, have been opened up, and at the present time there is sufficient shipping ore to last three years at an average extraction of 2000 to 2500 tons per month. During the year ending September 30 last the shipments were lower than usual, owing to labor troubles; 17,828 tons were shipped, containing 12,602 oz. gold, 13,393 oz. silver, and 539,000 lb. copper, the average being 14 dwt. gold and 1.5% copper. In addition to the shipping ore, there is a large amount of concentrating stuff, of which 11,840 tons were treated. This ore averaged 1.6 dwt. gold, 0.16 oz. silver, and 0.396% copper. Concentrates to the amount of 706 tons were obtained, averaging 18.6 dwt. gold, 0.859 oz. silver, and 1.22% copper. Sufficient profit was made to warrant £12,600 being distributed as dividend. A very interesting item in the history of the Le Roi No. 2 is the satisfactory way in which an additional property is turning out. This is the Vancouver mine at Silverton, which was acquired in August, 1906. Before that time the property had yielded the previous owners 923 tons, for which they received $76,380 from the smelters. During the last 18 months up to Jan. 31, 132 tons of picked lead ore, assaying 92.3 oz. silver, 34% lead, and 14% zinc, have been shipped, also 1100 tons of lead concentrates assaying 117 oz. silver, 60% lead, and 11% zinc. The total receipts for ore and concentrate were $119,030. The concentrating ore averages 13½ oz. silver, 3.7% lead, and 4.7% zinc. There is not much trouble in concentrating by ordinary water methods. The mine is so promising that it is to be floated as a separate company, the capital of which is to be £100,000. Of the shares 30,000 are to be offered for subscription, and the money so raised is to be used in providing additional plant. The Le Roi No. 2 company also owns interests in Queensland, having shares in the Cloncurry Syndicate. The first dividend from this source, amounting to £4425, was received the other day.

SALT LAKE, UTAH.

Injunction in Smelter Smoke Case Suspended.—Citizens Celebrate Court Decision.—New Plant for Ohio and Yampa Companies.—Ontario Drainage Tunnel.

The United States Smelting, Refining & Mining Co. has won a great victory in the Federal Court here through an order of Judge John Marshall suspending the injunction against the operation of its lead smelter at Bingham Junction. The order of suspension came as a result of the hearing during the week on the application of the company for a modified decree which would permit it to operate its lead smelter again under certain restrictions set forth in the application. The hearing lasted for three days and a large number of witnesses gave testimony of a technical character to substantiate the claim of the company that its engineers had made such metallurgical triumphs that no doubt remained that the noxious substances contained in the fumes, which had been responsible for the damage done to vegetation in the past, could be conserved by being introduced into bag-houses, and there subjected to processes which would completely eradicate the poisonous elements. The attorneys for the farmers who had banded together to fight the smelters in the now famous smoke cases made a vigorous objection to the granting of any concessions whatever to the company, notwithstanding that they had already agreed to a stipulation which permitted the American Smelting & Refining Co. to operate its lead smelter at Murray. This fact unquestionably aided the U. S. R. & M. Co. materially in getting its proposition again before the court. Judge Marshall made reference to it in his opinion, which was given orally, and stated that the terms under which the American Smelting & Refining Co. was permitted to operate were more liberal than those requested by the competing company in its application. The court indicated also that had the United States company made the showing in the previous hearing of the case that it did this time, no injunction to put the smelter out of business would have issued.

Inasmuch as the injunction has not been dissolved, but merely suspended, it is of course necessary for the United States company to demonstrate further that no damage will be done in the future. Officials of the company declare they know this can be done. Under the restrictions mentioned in the application, the smelting company must absolutely stop all solids, including arsenic, sulphuric acid, copper, lead, and antimony dust, and may emit from the

flue only three-quarters of one per cent sulphur dioxide gas to the total volume of smoke. The restriction will limit the amount of sulphide ores that may be treated, but this restriction will be on the basis of the gas sent out rather than of the tonnage used.

The result of the controversy has been received with a good deal of satisfaction by the mining and business fraternity in general, while officials of the company have received a flood of congratulations. The citizens of the town of Bingham Junction went wild with enthusiasm when the news from the court-room was announced. Amid the blowing of whistles, the ringing of bells, and keeping time to the music of the village brass-band, men, women, and children paraded the streets in joyous hilarity, as it meant the re-employment of men who had been without work since the smelters were closed in the early part of January. The resumption of work at the lead smelter alone will mean the employment of about 750 men and a payroll of $75,000 monthly. While nothing officially has been given out to that effect, it is likely that steps will shortly be taken to obtain similar action which will permit the operation of the copper smelter again. Not long ago the U. S. company offered to pay the farmers a bonus of $90,000 if they would enter into an arrangement similar to that effected with the American Smelting & Refining Co. This was refused, the farmers wanting more. Under the suspended injunction the company will not be obliged to pay tribute. It cost the American Smelting & Refining Co. $40,000 bonus money to make peace with the farmers, besides other sums paid to individuals instrumental in bringing about the deal.

During March the Utah Copper Co. treated in its Garfield and Copperton mills an average of 5000 tons of ore daily, thereby breaking all previous records. The tenth section of the Garfield concentrator will probably be in service within ten days.——Local shareholders of the Ohio Copper Co. are much disappointed over the slow progress being made toward the financing of that enterprise. Advices from Boston indicate that the plan to consolidate the Ohio and Bingham Consolidated companies has not been successful. The Ohio is regarded as one of the best copper mines in Bingham, and engineers estimate that 20,000,000 tons of ore are actually blocked out in the mine. The control of the company is vested in F. Augustus Heinze, and his downfall has seriously interfered with plans which included the installation of a concentrating mill with capacity sufficient to treat 2000 tons of ore per day. The steel building is finished and the equipment for it has either arrived in camp or is hung up at Bingham Junction, where 25 cars of mill machinery are awaiting disposition.——The Yampa Smelting & Refining Co. of Bingham, Utah, recently placed an order with the Allis-Chalmers Co. for plant, consisting of two electrically operated converter stands, with six converter shells, the converter dimensions being 84 by 126 in. The order included a cross-compound blowing engine for supplying air-blast to the converters, electric motors, a complete silica-crushing plant for converter-lining, tamping machinery, cars, ladles, and moulds. Practically all this material has arrived at its destination, and construction of the building in Bingham canyon is in progress.——Ore shipments from Park City last week amounted to 653 tons, the distribution being as follows: From the Daly Judge mine, 240 tons; from the Silver King, 360; and from the New York Bonanza, 53 tons. It is expected that the new zinc plant at Park City will be started by the end of the week on middlings from the Daly Judge mill, beginning its career by treating 50 tons per day. The Daly Judge Co. has between 12,000 and 15,000 tons of this material which has been contracted for by the builder of the works, the Grasselli Chemical Company.——Splendid progress is being made in the restoration of the Ontario drainage adit. The water in Ontario No. 2 shaft will be lowered to the 1400-ft. level within a week, leaving only 100 ft. more to be drained to reach the adit level, which should be accomplished before the close of the present month. The water is being drawn off through 13 holes drilled through the main avenue from a parallel drift. The average length of the drill-holes is about 30 ft.——Ore shipments from Tintic last week amounted to 67 carloads, the contributing mines and amounts being: Centennial Eureka, 49; Bullion Beck, 6; and Eureka Hill, 12 cars.——On the resumption of operations at the United States lead smelter the following companies in the Tintic district, which had their output contracted to that concern, will be requested to resume shipments; namely, the Grand Central, Mammoth, Lower Mammoth, Colorado, Beck Tunnel, and Uncle Sam Consolidated. ——Articles of Incorporation of the Boston-Sunshine Gold Mining Co. have been filed with the Secretary of State, the basis being the Sunshine mine and mill in Tooele county. A. W. Chesterton of Boston is president and John Dern of Salt Lake vice-president.

ROSSLAND, BRITISH COLUMBIA.

Ore Shipments.—Operations at the Granby.—Big Output.—Consolidations.—Sullivan Group.

Rich gold-bearing quartz is still being taken from the lower levels of the Le Roi and Consolidated properties. They are shipping about 850 tons of this ore per week from the War Eagle. A recent shipment of 200 tons averaged $55 in gold.——Shipments from Rossland for the week ended March 28 amounted to 5966 tons. For the Slocan and Kootenay the shipments were 1969 tons. The smelter receipts at Trail were 5467 tons, and at Northport (Le Roi), 1950 tons.

The Granby shipped 27,288 tons of ore during the week mentioned above, which, it will be noted, is the largest weekly shipment they have made up to date. The totals for the year now run 246,796 tons mined and 239,587 tons smelted. The tonnage shipped during March exceeded the 100,000-ton mark, which was the largest in the history of any copper mine in Canada. Owing to the expensive fixed charges at the smelter and mines, it is more economical for the Granby to operate, even with copper at its present low price, than to remain idle.——A fresh rumor was going the rounds the other day that the Consolidated Co. would soon absorb the B. C. Copper and Dominion Copper companies. This is denied by J. E. McAllister, of the B. C. Copper Co., who states that they will resume operations on their own account as soon as the price of copper rises.

The mine and smelter of the Sullivan group are in the hands of the sheriff at the present time; the Crows Nest Pass Coal Co. has taken action for $7000, which this company owes for coke, and liens to the extent of $20,000 have been filed by the men who worked at the mine and smelter. A. I. Goodell, the superintendent, has instituted proceedings to recover $10,000 for breach of contract. Despite this tangled state of affairs, it is stated that work will be resumed immediately. Thirty men are now working at the Hewitt. There is considerable milling ore in reserve. The assets of the Pioneer Mining Co., owning the Black Prince, Bank of England, and other claims, have been sold at auction to a Nelson syndicate. Hard iron oxide ore, shot through with native silver, has been cut in some of the old upper workings of the North Star. The Victor-Silver Leaf group, near Fort Steele, is improving as work progresses. This property is owned by Spokane people. The clean ore carries from 40 to 50 oz. silver and 76% lead. Iron pyrite in the ore carries from $10 to $12.60 in gold.——Twenty tons per day of $60 to $100 copper ore are being taken from the Ikeda mines by the Japanese operators. When new machinery, now on order, is installed the output will be increased to 50 tons per day.

The two most important producers in this district are the Le Roi and Le Roi No. 2 mines. The Le Roi, situated on the southern slope of Red Mountain, within the limits of the city of Rossland, B. C., was located in July, 1890, by two prospectors, who also staked the Centre Star and War Eagle claims. E. S. Topping of Trail recorded the group for them and received as compensation the Le Roi claim, which up to this date has proved to be the richest piece of ground on the property. The Le Roi, consequently, cost Mr. Topping $12.50, and in November of the same year he bonded the property to a Spokane syndicate,

receiving $16,000 in cash as the first payment. The purchase by the present English interests, controlling the mine, involved a cost of $3,750,000 for the stock, at the rate of $6 and $8 per share. The first division of profits earned from the product of the mine was made in 1896, amounting to $25,000; up to the present time the dividends paid to the shareholders sum up approximately $1,345,000. Shipments of gold-copper ore from the Le Roi mine during the last four years have been as follows:

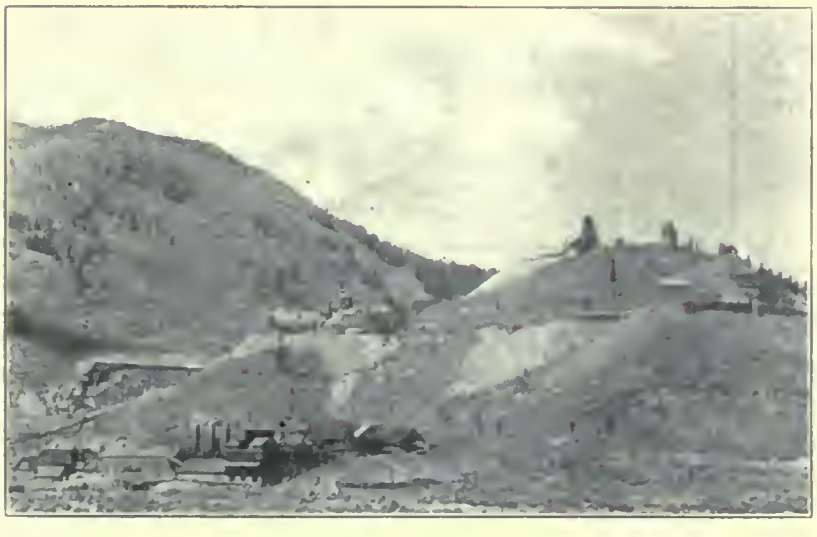
Year.	Tons.	Average value per ton.
1904	160,110	$10.94
1905	114,960	12.41
1906	110,042	12.37
1907	131,696	10.49

The cost of mining and treating this ore was:

	1904	1905	1906	1907
Ore production	$ 2.65	$ 2.78	$ 2.84	$ 3.00
Exploration and development (amount written off)	0.94	0.90	1.26	0.84
Depreciation on mine account	0.21	0.34	0.36	0.20
Smelting and marketing (direct and indirect), including freight, interest, depreciation of plant, etc.	6.77	6.06	6.04	5.98
	$10.57	$10.08	$10.50	$10.02

The average ore carried 0.29 oz. gold, 0.44 oz. silver, and 0.98% copper.

Development work done during last year cost per foot:



Red Mountain, Rossland, B. C.

Raising, $41.99; winzing, $41.34; cross-cutting, $14.88; driving, $15.71; diamond-drilling, $2.79.

While the orebodies worked during the year were extensive, the value of the ore was about 15% lower than of the ore mined during the previous year. The ore is of higher grade in narrow veins in this camp, but runs low in the large lodes. The principal development work done in the mine during last year was the deepening of the main five-compartment shaft from the 1350 to the 1650-ft. level and the sinking of a winze from the 1650 to the 1750-ft. level. The work done on the shaft cost $49,545. The claims controlled by the company in this camp are the Le Roi, Le Roi Fr., Black Bear, Durham, Tat Fr., and Treadwell. In the report of the directors for the year ended June 30, 1907, the balance in favor of profit and loss after payment of dividends and provisions for various contingencies is £3582 4s. 5d., or a surplus of $17,408.52. The amount of £22,690 15s. 8d. was written off for exploration and development and the sum of £7766 13s. 7d. was written off for depreciation on machinery, plant, and surface improvements. A dividend of 2s. per share, from the profits of 1906, amounting to £20,000, was paid during the year. The liabilities are shown as £45,329 12s. 7d.; liquid assets, £119,589 11s. 11d., showing a surplus of assets over liabilities of £74,259 17s. 4d. The smelter at Northport only worked 154 days during the year, part of the ore having been smelted at Trail. The quantity of matte shipped to the refinery from Northport was 753 tons, of a net value of $339,036.30, equal to $450.24 per ton. On June 30, 1907, they had 900,000 lb. of copper in transit, which was sold on a falling market.

During the year 17,828 tons of ore were shipped from the Le Roi No. 2 mine, of the Le Roi No. 2 Ltd., which was a much smaller output than for the preceding year. This was due to several causes, chief of which was the exceptionally severe winter and the prolonged strike of the coal miners at Fernie. The Vancouver mine has developed satisfactorily during the year, and the directors feel that the time has now come for this property to be dealt with as a separate concern. The company's interest in the Cloncurry Syndicate has resulted advantageously, and since the date of the balance-sheet a dividend amounting to £4425 has been received from this holding.

During the last year a little over 130 ft. of development work has been done. This includes work on the Mayday adit, and in a new adit high up the hill which is called the West Poorman. The work on the Mayday has revealed a small quantity of easily broken pay-ground, and the West Poorman adit opened up a promising streak of ore from 2 to 3 ft. wide assaying about $20 per ton. Toward the end of the year the Hamilton vein was found on the 300-ft. level in the unexplored region between the tramway and the porphyry dikes. This discovery was the direct result of the appearance of stope 32 above the 500-ft. level. The ore found is of a good shipping grade, and during the next 12 months regular shipments will be made from the Hamilton vein on this level. A considerable amount of driving and raising has been carried on close to the shaft on the 400-ft. level.

On the 900-ft. level the Hamilton vein has been found west of the tramway dike, and has shown good ore for a distance of 90 ft., after which the ore became scattered and work was suspended. This work will be resumed just as soon as the necessary information regarding dip and strike is forthcoming as a result of the work on the 700-ft. level. In the meanwhile stoping operations on the short streak opened up are resulting favorably. An average sample taken from this stope in October, 1907, went $20 per ton. In addition to the work done on the Hamilton vein, the southerly cross-cut was extended over 300 ft. The direct result of this work was negative, but diamond-drilling has revealed the presence of valuable ore some 320 ft. below. The depth of this ore below the collar of the Josie shaft is 1150 ft., which is the deepest point at which ore has been found on the property. During the year 2537.7 ft. of driving and cross-cutting was done, and 255.4 ft. of raising. This work cost $40,713.21, or $14.57 per ft. During the year 5088 ft. has been bored by the diamond drill. Probably the most important result of this work has been the development of the Hamilton vein on the 300-ft. level. The diamond drilling cost $13,272.20, or $2.61 per ft., as compared to $1.86 per ft. last year. The increase in cost is largely due to the increased cost of carbons, but higher wages have also added considerably. The result of the unwatering and sampling of the No. 1 mine has not so far been satisfactory. The task of prospecting the No. 1 is being continued with diamond drills.

The production during the year was 17,829 tons of shipping ore and 11,840 tons of concentrating ore, and 3400 tons left broken in the stopes, making a total of 33,069 tons. The total stoping costs for the year amount to $123,787.48, showing an average on above tonnage of $4.40 per ton, and

diamond drilling has cost $13,272.23, or $0.48 per ton, in all $4.88 per ton. There has been written off for depreciation $53,849.52, averaging $1.92 per ton. The total costs, therefore, per dry ton mined, are $6.80 per ton. Of 17,826 tons of shipping ore sent to the smelter during the year, the gross value was $21.90 per ton. The total smelting charges on the ore, direct and indirect, were $6.12 per ton.

MEXICO.

Mexican Railroad Nationalization.—Consolidation of Harriman Railroads.—Smelter at Tapalpa.—Mexican Mines' Prospects.

The great Mexican railway merger, or the consolidation of the National Railways of Mexico with the Mexican Central Railway under Government control, which was close to accomplishment last year, when the financial depression necessitated its being laid on the table, is again brought prominently into the foreground by the signing in Mexico City, on March 28, of the articles of incorporation of the new holding company, and the election of seven members of the board of directors, who will later choose others to make up the full board of 21, of which number 9 may live abroad and form a local board to sit in New York. Among those selected are Pablo Macedo, a prominent lawyer of Mexico City, who will probably be chosen chairman of the board; Richard Honey, of the International & Mortgage Bank; Joaquin D. Cassasus, former ambassador to the United States, and Guillermo de Landa y Escandon, Governor of the Federal District of Mexico. The organization of the new company was fully outlined in these columns during July of last year, the time of its authorization, but it may be briefly repeated that the company is to be capitalized at $230,000,000 (₱460,000,000), or 2,300,000 shares of $100 par value, of which there shall be first preferred, $30,000,000; second preferred, $125,000,000; and of common stock, $75,000,000. The company is authorized to issue further preferred 4½% mortgage bonds of $231,000,000 and ordinary 4% mortgage bonds of $186,000,000. These bonds carry with them an absolute "guarantee on the part of the Government of the United Mexican States for the punctual payment of principal and interest," and for and in consideration of this guarantee, together with the Government's present holdings in the National Railways of Mexico, the Mexican Government receives outright, without any immediate cash outlay, 1,150,023 shares of the 2,300,000 shares in the new company, giving it the control. As the articles of incorporation provide for the guaranteed payment of dividends from January 1, 1908, for three years, whether earned or not, it undoubtedly contemplates that the complete transfer to the new company will be made in the near future. If the consolidation is followed by as many improvements throughout the whole system as followed on the Government's obtaining control of the Mexican National, the change will certainly be welcomed by everyone in Mexico.

Word also reaches us that all the Harriman roads are to consolidate, which in Mexico means the Sonora, the Cananea, Yaqui River & Pacific, and the Guaymas-Guadalajara line. It is to be hoped such may be the case, for it should hasten a number of much needed cross-connections in the State of Sonora. On the Guaymas-Guadalajara line work is being pushed as rapidly as possible, also from the Guadalajara end, and something over 10 miles has been constructed out from Orendain station on the branch of the Mexican Central. From 600 to 700 men and 100 animals are kept busy, and the 4000 tons of 75-lb. Russian rails and the 35,000 bbl. Russian cement were taken to the Guadalajara end by way of Tampico. Supplies for the western end go to Guaymas.

At Tapalpa, in Jalisco, the Keystone Copper Co. has had a sad experience with the Poehle-Croasdale process of ore reduction, on which the company's good money was spent only to end in failure, so that the same has been thrown out and the small smelter at Etzatlan has been purchased and is being moved to Tapalpa. The company is also experimenting with cyanide on some of its non-copper ores and tailing.——The Mexican Mines Prospects Development Co. is becoming unusually aggressive for a new company. Organized in Mexico City but a few months ago with José L. Riqueña, president of the Dos Estrellas Co., of El Oro, at its head, it has already acquired some 82 pertinencias in the Hostotipaquillo district of Jalisco, known as the San Luis del Oro group; and in Pachuca has taken up the Estrellas de Pachuca and the Gibraltar y Anexas, and those in a position to know say that the properties in both camps are most promising prospects, and worked with the capital and energy with which this company is so well provided, should soon prove profitable.

The Boca del Cobre Mining Co., owning mines at San Luis del Cordero, Durango, has just purchased the Santa Rita, San Francisco, San Nicolas, and El Rosario mines, at Nieves, in the State of Zacatecas. These are developed properties, the Santa Rita having a shaft 900 ft. deep, equipped with a 75-hp. hoist, pumps, etc. On the 800-ft. level a drift 1275 ft. long has been extended, continuously

Mexico.

in ore. The company claims ore reserves valued at ₱2,000,000. A new water-jacket furnace of 120 tons capacity will be ready for blowing in about June 1, using copper as a collecting medium, arrangements having been made with the American Smelting & Refining Co. to supply the necessary copper. The resultant matte will be shipped to the latter company.

Notwithstanding the lack of transportation facilities, considerable activity is noticeable in the vicinity of Toluca, in the State of Mexico, particularly in the districts of Sultepec, Zacualpam, and Temascaltepec, largely due to the power furnished by the Sultepec Electric Light & Power Co., of which the La Quimica y Anexas was the first to take advantage by thoroughly equipping mines and mills with electrically driven machinery. This lead has been followed by the El Rey Mining Co. in the installation of electric hoists and pumps, and now that good ore has been struck in its Santa Ana mine, a 2-mile overhead tram is to be built to connect the mine with its Guadalupe mill, and a complete electrical equipment has been ordered from the Westinghouse Co. through G. & O. Braniff. The Los Arcos M. & S. Co. has temporarily closed the smelter near Toluca, and is making preparations for the erection of a 100-ton concentration and cyanide plant at its mines in the Sultepec district. The Carboncillo in the Zacualpam district has struck good ore and is adding 15 stamps to the mill, though the selected mineral is sent in to Toluca for shipment at the smelters, but this company, instead of installing electrical machinery, is erecting gas-producers and engines at the mill. The Genovesa has also encountered high-grade ore and is shipping to Toluca. The Santa Inez Co. has been organized in Mexico City with a capital of ₱175,000, and the

La Gerardita, with a capital of ₱200,000, for operating on properties in the Zacualpam district, near the Carboncillo.

In the El Oro district of the State of Mexico the Borda Antigua y Anexas is placing electrical equipment throughout at mine and mill, for pumps, tube-mills, crushers, and so forth, making a total of 500 hp., all of which will be from the Westinghouse Electric & Manufacturing Co. The Descubridora has started the cross-cut from its 750-ft. level and the progress of this cross-cut will be watched with a great deal of interest, as all look to it to prove the southern extension of the San Rafael and other important veins of the El Oro district.

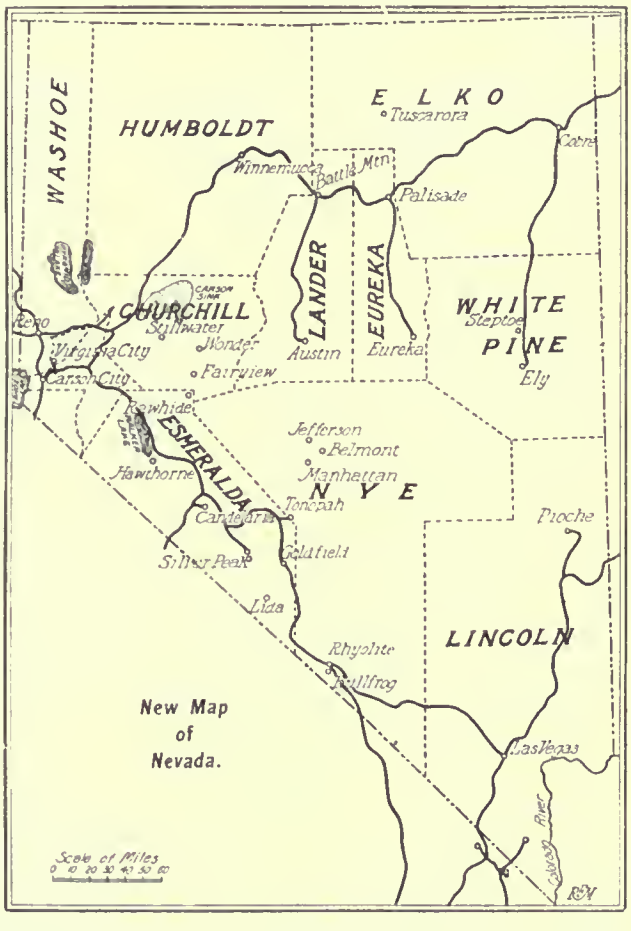
GOLDFIELD, NEVADA.

Rawhide. — Geological Conditions.—Ore Shipments.—Exaggerated Statements.—Fairview and Stimler Camps.

The geology of that part of the Regent district, in Esmeralda county, comprised within the scope of operations of the Rawhide camp is as yet only imperfectly worked out. In general it may be said to be a region of acid lava flows, consisting of rhyolite, or perhaps dacite, often displaying a perlitic structure. The latter type, which is common all over the district, is always extremely acid. On McLeod hill is an exposure of a granular rock, provisionally identified as diorite. On the west side of Balloon hill is a large exposure of kaolinized felsite, the comb of the ridge being sheared slaty rhyolite. Another intrusive coarse granular porphyritic rock is noted on Hooligan hill. No dikes are in evidence, but the country has been extensively brecciated by faulting in at least two directions, approximately at right angles to each other, north and south, and east and west. Little or no silicification followed this faulting. At one point, in the northwestern portion of the camp, faulting has been later than the silicification of the effusive lavas, the brecciation of an older cemented breccia occurring along the same zone as the original faulting. The gold occurs largely in seams, with occasional rich streaks from a fraction of an inch to one inch in width. The deposition of the precious metals does not follow the fault-lines within the brecciated zones, but appears to be quite erratic. It is noticeable that whenever the mineralization has taken place the fine material is richer than the hard quartz. All the stringers of enrichment pan well, but the gold not being fine or flaky, and worth only about $12 per oz., owing to the large proportion of silver in the native alloy, it shows up better in the pan than subsequent assays will sustain.

Up to the present time the most conspicuous properties are the Rawhide Consolidated, the Rawhide Queen, the Townsite group, the Mascot group, and the Royal & Tiger groups.——The Murray lease on the Rawhide Consolidated consists of a silicified zone revealing at the shaft, so far as uncovered, a width of 25 ft. The quartz ore from the dump assayed $24 per ton, of which amount about $8 was gold. Balloon hill belongs to the Rawhide Queen Co., and some good leases are found on the western slope, chief among which are Kearns No. 1 and No. 2, the Butler and the St. Ives leases. Two carloads gave returns of nearly $100 per ton. From some of these lodes very high assays have been obtained, though exaggerated figures have been published. On the south side of McLeod hill is the Miller lease on the Happy Hooligan claim, and on the contact between the diorite and the felsite it shows 3 ft. of good ore, probably worth $25 per ton. This belongs to the Townsite Co. The Mascot claim is located on Grutt hill, and originally yielded some exceedingly rich ore, but later sampling has proved disappointing, the value having dropped, as shown by one careful sampling, to $6 per ton. No well defined veins or silicified zones appear, and the indications are that the ores on this hill will be 'bunchy' and erratic. The Royal claim shows about 5 ft. of crushed country rock, with very little quartz. A seam of gouge on the foot-wall pans well, but a carefully taken sample showed only $12. It is noticeable, however, that contrary to the rule in this camp, the alloy ratio was 1 of gold to 4 of silver by weight. Near to this lies the Bushwhacker claim, on which is the Kirk lease. The outcrop has been opened up, and reveals a 4-in. pay-streak assaying $54 per ton. The camp shows a wide distribution of gold, but not enough has as yet been done to demonstrate the extent to which surface enrichment may have taken place. Altogether the most encouraging prospects would seem to be those on Balloon and McLeod hills, and the Murray lease.

The camp of Fairview is prospering; in the Eagle, on the 200-ft. level a drift is being extended on a vein that has been shown in a number of cross-cuts to average 21 ft. wide; the superintendent says that the average is about $35, and the ore looks like it. This orebody reaches into the Aztec, and is now shown in the Eagle drift only 150 ft. from the latter's end-line. The Hills is doing only development work, and the owners are discussing the erection of a mill. They have over 10,000 sacks of high-grade ore and the mine certainly looks prosperous.——The Stimler district, 8 miles south of Silver Peak, has a series of four or five parallel veins in rhyolite with dikes of porphyry near the foot-wall; these veins traverse a tract 1½ miles wide,



and can be traced on the outcrop for 15,000 ft. The vein material is spar and quartz highly leached by surface waters, the values being one-third gold and two-thirds silver. The gold is free and the silver occurs as a sulphide and as horn-silver. About 25 sets of lessees are at work, and have three shafts over 150 ft. deep; cross-cuts at this level show 26 ft. of ore on the main lode, several feet of which is of shipping grade ($100) or better. The camp is 18 miles by road from the railroad at Blair, and a new road being constructed brings it 10 miles from Blair. It was discovered last summer by Harry Stimler and Henry Jagels, and a three-quarters interest sold to some local mining men for $92,500. I understand a one-third interest has since been sold to some New Yorkers for $300,000. This camp will make good, and from present indications should be a rival to the big company at Blair. There is no excitement nor stock-jobbing nor townsite boom, only mining.——The Kaeding Construction Co. is building a 50-ton mill and cyanide plant for the Ramsay-Comstock Mining Co. at Ramsay, and George L. Kaeding is at Ramsay, personally overseeing the work. This plant will be running in three months.

Concentrates.

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

Location.—There is no State law in California prescribing the manner of locating mining claims.

The ordinary speed to run single-stroke pumps is 100 ft. of piston travel per minute, double-stroke pumps should have 140 ft. of piston travel per minute.

For the successful roasting of zinc ores a higher temperature is needed than for roasting lead and copper ores. Zinc sulphate is formed in the roasting, which is only decomposed at the highest heat of the roaster.

Metallic iron is not found in a copper blast-furnace because the atmosphere is not sufficiently reducing to change the ferrous oxide to metallic iron. Ferric and magnetic oxides should be reduced to ferrous oxide, which readily combines with the ore to form ferrous silicate.

In pyrite smelting, insufficient air blast results in a low-grade product, that is, too much matte. All the oxygen blown into the furnace is used up at once in burning sulphur and iron, and more air is required to effect the degree of oxidation necessary for the greater degree of concentration.

In matte smelting, the amount of sulphur left in a roasted ore determines the amount of matte that will be produced by smelting. The copper in the roasted ore will first take up sulphur to form cuprous sulphide, and after this reaction is completed the remaining sulphur will be taken up by iron to form ferrous sulphide.

Copper slags may be economically removed by granulation. For this a cast-iron launder is arranged to receive the slag, and a good flow of water maintained. In addition a horizontal jet of water is arranged to strike the falling slag, cooling and breaking it up, when it is swept away in the launder to the dump. The launder should have a grade of one inch per foot.

Annual Labor.—It is doubtful if the Act of March 31, 1891, Stat. 1891, p. 219, is in force. It is customary, however, to file proofs of annual labor. A failure to file such proof does not render the claim subject to re-location. Such filing, where authorized by law, is a convenient method of proving prima facie that the work has been done, but it is optional, not necessary, and no penalty is attached for failure to file.

Most of the hard steel at the present time is made in the open-hearth furnace. Enormous quantities are used for car-springs and agricultural machinery, and both the acid and basic furnaces furnish a share. There are, however, some purposes which require a steel free from the minute imperfections often present in open-hearth metal. Such is the case in watch-springs, needles, and razors, and it is found that the old crucible process gives, in the long run, the most satisfactory metal for such work. The process consists of putting into a crucible a proper mixture of scrap, pig-iron, or charcoal and heating it until everything is thoroughly melted, the crucible being kept tightly closed to prevent the admittance of air. This process is a century old, but seems likely to survive for many years longer.

Kerosene should never be used in an air-cylinder, but, instead, fill the oil-cup with soapsuds made preferably of soft-soap, one part soap to fifteen parts water, and feed this into the air-cylinder. Let the compressor work with soapsuds instead of oil for a few hours, or say a day each week. Feed the solution liberally and then open the receiver blow-off and drain off the accumulation of oil and water. This cleaning process should be repeated as often as necessary, the exact intervals depending on the service of the compressor. If running at full capacity for 24 hr. per day, about once every week or two will be sufficient. If on a light load and running for 8 to 10 hr. per day, once every month or two will do very well. The soapsuds can do no harm, but care should be taken to feed with oil a half-hour before shutting down, so that the parts may not be subject to rust, which is the only danger from the use of soapsuds.

Cyanide in Creek.—A mining company owns property in a gulch a mile above town. The company has been operating a stamp-mill for several years, impounding the tailing, but delivering the water into the stream. Residents of the town sunk a concrete cistern to bedrock to get water for domestic purposes. During August and September the creek dries up. The mining company purposes building a cyanide plant, but the owner of the water system objects. (1) Will the water be contaminated, if the pulp is properly impounded? (2) What standing would the owner of the cistern have in court? To these queries we reply thus:

(1) Whether or no the water from the cyanide vats which would ultimately flow to the cistern mentioned would reach the cistern free from noxious elements, would depend on circumstances. If such elements existed in suspension, the filtering through the gravel might and probably would clear it. If in solution, they could not be eliminated without precipitation. If we owned the cistern we would not like to take any chances.

(2) The owner of a water right must so use it as not to injure his neighbors. He would not be permitted to contaminate the water to the detriment of lower proprietors. He might possibly have a right to consume all the water, but this would not permit him to contaminate such as necessarily flowed to lower levels. We think the proprietor of the well could enjoin the contamination of the water under the circumstances stated.

Discussion.

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy.

Copper Assay.

The Editor:

Sir—In your issue of March 14 you publish a letter from E. G. Rice, suggesting the use of copper in place of platinum for the electrolytic copper assay. Mr. Rice says: "It occurred to me to use two cylinders of pure electrolytic copper for cathodes, instead of platinum." If Mr. Rice means electrodes, that is, cathode and anode, where he says cathodes, trouble is obvious; for the anode of copper would plate over to the cathode, as in the electrolytic refining process, and the result would be useless.

However, granting that it was the intention to use platinum or gold for anodes, and copper for cathodes only, the scheme is scarcely practical, for it would defeat the high accuracy of the method unless very elaborate precautions were taken. It is difficult to keep copper at anything like the constant weight in a laboratory atmosphere, and in addition the stem, or exposed part of a copper cathode showered for twelve or more hours by the escaping gas bubbles, with the acid electrolyte, would oxidize and crust and change enough to make the work unreliable. Again, it would be necessary to pickle, rinse with water and alcohol, dry, and weigh just before each solution was put on the battery. The theory is all right, just as it is with aluminum, but an intimate acquaintance with the electrolytic method convinced me that for satisfactory reliable work, where speed and accuracy are required, platinum (or gold) is necessary.

The successful use of stirrers in electrolytic analysis has made one pair of electrodes do as much work as five or six when the electrolytes are not circulated, so that an ample electrolytic outfit is not now so very costly.

E. L. LARISON.

Isabella, Tennessee, March 16.

Mine Fires.

The Editor:

Sir—In your issue of March 28, W. O. Snelling suggests the use of sulphur dioxide in combating mine fires. While I am not aware that it has been generated for the express purpose of producing an atmosphere that will not support combustion, it is used in this way in the case of fires in sulphide ore-bodies, where the so-called 'plenum' system of ventilation is employed. In this case fans blow air into the mine, and these are regulated so as to force back the sulphur dioxide and other products of combustion into the fills or crevices, and thus keep a neutral atmosphere in the fire zone and a supply of fresh air in the workings. The system proves only partly successful, and, while making it possible to work the mine, it does not put out the fire. The gas may not be sufficiently concentrated, but in my experience of mine fires, the intense heat altogether reverses the position of the air and sulphur dioxide in the drift, and the hot gas will be found at the top of the opening and the cold air beneath, while the stopes may have an up-draft and the raises be like a furnace-flue. In copper mines, damp rotting timber impregnated with sulphide dust is spontaneously combustible, and the chemical reactions are so violent that it is difficult to compare this experience with that of gob fires in coal mines. In the former case, it has been found that a little water tends to increase the fire, probably because chemical reactions are stimulated and the water dissolves the crystallized sulphates, and opens passages for the ingress of air currents. The intense heat of rock masses in mine fires is not generally realized. In sulphide mines I have observed rock temperatures exceeding 800°F, and the fine ore will burn as it falls through the air. At the Homestake mine, ore was mined at a red heat, at a temperature said to be about 1500°F. In the latter case, even the heat would cause currents of air and gas that would require careful consideration, and there is little doubt that the question of flooding a mine with any gas involves serious difficulties.

D. F. CAMPBELL.

San Francisco, March 30.

Winter Phenomena in Siberia.

The Editor:

Sir—I send you herewith a brief description of recent phenomena that occur here under favorable conditions. We recently witnessed an occurrence similar to that recorded by myself last winter, which you labeled 'Mock Suns.'

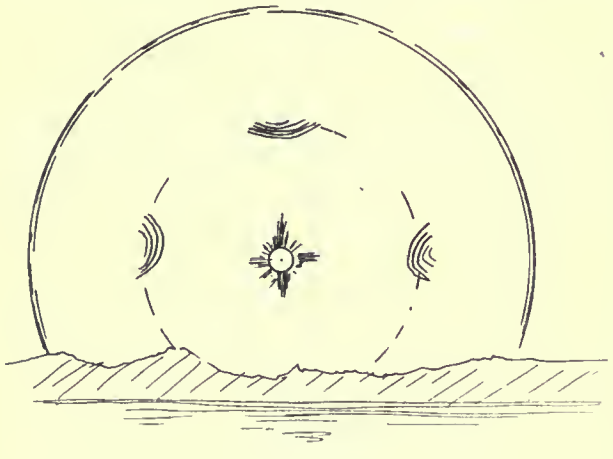
On January 10, 1908, at 10:30 A. M., the sky to the southward had the appearance shown in my sketch. There was a wide, and about three-fourths part complete, circle of light, showing the prismatic colors distinctly, although faintly. Inside there was another luminous circle, all but complete, with segments of brilliant illumination at three of the quadrants. This circle was not quite continuous, as the luminous circle could scarcely be said to join the bright segments, and, moreover, showed no prismatic colors.

The sky was perfectly clear, and the sunshine brilliant. Overhead there could be discerned, drifting slowly in the still air, minute needle-like crystals of ice, not snow. The temperature was 0°F. The luminosity of the quadrants was not of the intensity of the sun, and as the phenomenon vanished before noon, the intensity of the 'mock suns' was not as great as in the former observation (which occurred shortly after noon), when it was nearly as bright as the sun itself. You impute this peculiar occurrence, I believe, to the refraction of light on the ice-crystals passing in the upper currents of air.

Another phenomenon, which is witnessed during the first cold weather of the fall, pertains to the sunsets. On these occasions the rays of the setting sun are focussed into one perpendicular ray of light stretching almost to the meridian. The divergent fan-like rays of the sunsets are seen earlier in the season, and are of extreme beauty. For a short period, if the weather gets colder, and conditions are favorable, there is but one ray, bold, vertical, and rose-hued, that reminds one of nothing so much

as that biblical "pillar of fire by night"—a recorded phenomenon of other days.

The next phenomenon is not quite so pleasing. Its occurrence was on Christmas day, which comes 13 days later than ours, as Russia still adheres to the Gregorian calendar. In winter, across the broad flat steppes, blizzards, or *boorans* as they are called, are not uncommon—in fact, one is raging as I write. This *booran*, however, was what is known as a 'cold' one, a visitation of considerable dread on account of the danger to life if caught unprotected. The air was so thick with flying wind-driven particles of snow that objects even ten feet distant were all but invisible. On leaving the shelter of the house but a few feet away all objects were invisible—the house itself being indiscernible. Snow seemed to converge from all directions, blinding the sight and limiting the illuminated area to but a few feet in any direction. A gale of wind was blowing, with the thermometer at about 0°F or lower. Exposed to the fury of the wind, the face became chilled and in danger of freezing. To find a way was almost an impossibility. In fact, although I made the at-



Sun Phenomena.

tempt twice during the day, each time I deemed it prudent to beat a retreat, and found my own house then with difficulty, although the boarding-house, whither I essayed to go, was but a stone's throw distant. The danger consisted in the chance of missing one's mark and wandering on the open steppe, exposed to such weather it would not take long to kill all vitality. All sense of locality is as effectually blotted out as when lost in a November fog in London and, here one is not able even to "ask a policeman."

We have no local papers in these parts, and so news filters through slowly. We lost two men at this camp: one returned after being out all night, while the other is lost and his resting-place unknown, until the snow shall be compelled to give up its dead. At a neighboring camp two men were lost. Numbers of men, women, and children were badly frozen, some so badly that amputation was necessary. The number of sheep and cattle that perished must have been great.

To one that has not experienced such a wanton display of winter fury, it must seem incredible that it is actually unsafe to attempt even short journeys of a few hundred feet from the house, but such is undeniably the case. Happily these cold *boorans* are uncommon. Usually when the wind increases and the snow whirls over the steppe, the temperature rises to well above zero, but there are occasions when the thermometer refuses to rise. Such an unhappy record has the winter of 1907.

H. E. West.

Akmolinsk, Siberia, January 12.

Why Are Engineers Poor?

The Editor:

Sir—In the issue of March 14 your London correspondent refers to the fact that the financing, controlling, and business management of mining enterprises is almost entirely in the hands of laymen instead of mining engineers. The pertinent question is, why is this? Is the training of the engineer one that retards business acumen and aggressiveness? The engineer who would succeed must be a man of relentless initiative and organizing ability, conservative and calculating, with a world of experience. What element is lacking that we do not more often find him founding and heading enterprises in his own line of work? In nearly every one of the practical walks of life we see even the beginner determinedly setting his face and doggedly directing his steps toward being 'his own boss' and having a business of his own, but the mining engineer, with the best of opportunities along this line, allows someone else to skim the cream. Were the engineer's life one of indolence and ease, we could understand it, but it is one of severe mental and physical tasks from apprenticeship to retirement, one of nomadic existence, of life in undesirable and trying places, reputations easily lowered and positions of uncertain tenure—surely the reward should be great.

A prominent writer on business organization states the self-evident fact that a business undertaking has three essentials: the enterprise, the management, the capital; and he adds the observation that management is the greatest of these, since given a poor enterprise or little capital, or both, good management will pull it through or prevent an undue loss, while a good enterprise and plenty of capital is too often of no avail when harnessed to poor management, particularly in these days when competition is keen and promising prospects quickly snapped up. Can you expect to find this good management for a mining enterprise in a broker, or a druggist, or a clergyman—or in a mining engineer?

In every district we find villages deserted and properties closed down shortly after equipping or still containing good bodies of pay-ore, with only a few old-timers remaining to tell us "these hills have only been scratched." Had these properties been controlled, managed, and equipped by trained men, admitting many of the mines had but little merit, a large proportion of them would have run for years, supported thriving communities, and giving the stockholders a run for their money, sufficient at least to assure their interest in other properties, instead of making them decided opponents to mining investment. Logically, no man should be so well fitted to find the enterprise, to supply the management, and to attract capital by virtue of his knowledge of the

facts and opportunities, and his standing, as the trained man—the engineer. In practice he is too often unable—until well up the ladder of fame—to command capital because of the little opportunity to meet and form associations with men of means open for investments.

Some twelve months ago Mr. J. R. Finlay, in an article on 'Requirements of Modern Mining,' presented the necessity of the mining engineer being a good business man, and his frequent lack of business qualifications. I believe it can be truthfully said the mining engineer is not up to the standard of what should be expected of him in business ability. It is the business man of business attainments who is reaping the rewards in all lines of human effort. Someone will say the practice and technic of mining is sufficiently broad for any man, and very remunerative. Perhaps. But I notice every engineer looks forward to the time when his finances and business connections will allow him to settle down, unharassed by rough trips, arbitrary managers, and boards of directors, and discomforts of the mining camps. The salaried man, the wage earner, business man, and investor will all be benefited when the engineer makes his advent into organizing and managing enterprises.

The question at this moment is, what change must the engineer make in his training, and concept, and methods to enable him to come into his own.

H. W. MacFarren.

Blair, Nevada, March 18.

Concerning Superintendents.

The Editor:

Sir—In your issue of February 15 one of your correspondents in an article 'Concerning Superintendents' mentioned one who was—to say the least—very ignorant, and whose qualification for the position of superintendent was that he had taken a "ten dollar course in a correspondence school." Of course, I do not know what school, nor does it matter, but the slighting way in which the fact of the superintendent in question having taken a course in a correspondence school at all is mentioned, leads me to ask your correspondent if he means to condemn all such aids to self-education. Take a case like the following, for instance: Given a man who has been working underground for 30 years, and in camps ranging from the Sierra Nevada to Salt Lake, and from the British line on the north to the Mexican line on the south, during which time he has held every position from mucker to foreman, and given satisfaction to his employers, also that he is considered a good all-round miner and timberman, etc., capable of handling running ground as well as hard rock. This man wishes to rise to higher positions, but finds that his lack of technical knowledge is in his way. This he determines to overcome. He has others to support as well as himself, and so cannot spare the time to go to either Stanford or Berkeley, much as he would like it, and much as he realizes the importance of a university training. What then is he to do? He wishes to educate himself. Is he to refuse to avail himself of the help offered by such institutions as the International Correspondence School at Scranton, Pennsylvania. The cost of their course in mining engineering is nearer $150 than it is $10, that is, after the necessary outfits are bought. He has to sit up at night after work, and study, and he finds that the course is very thorough and that he has to get at least 75% on his examination papers, or they are not accepted. Does your correspondent mean your readers to infer that the fact that a man accepts the help that he can get in his studies should bar him from the ranks of the profession? I cannot think that the members of the profession are so illiberal and caste-bound that they will not admit to their ranks one who has educated himself, for the simple reason that he was not able to afford the luxury of a college education in his youth, and had to start in at the practical instead of the collegiate end. I will add that this is no imaginary case, but an actual fact. I will close by asking you if, after such a man has gained his diploma, can he expect recognition from the profession?

I well know the advantages of a college course over private tuition, even if the courses are identical, but under the above conditions what is a man to do? It seems to me that he would be foolish to refuse the aid offered.

C. R. G.

Sacramento, April 2.

[A man who makes the best of poor educational facilities deserves the respect of every professional man. Many men without the advantage of an academic training are better educated, and even more cultured, than university graduates. Whether an engineer got his training at a regular school of mines, a correspondence school, a night school, or by reading and observing on his own account, makes mighty little difference if he finally arrives, that is, if he becomes well trained and accurately informed. Some of these agencies for instruction are better than others, but the worst of them will make an intelligent earnest man more useful than the best of them when applied to a natural chump. Professional men are not illiberal; we welcome any man that can 'make good,' and if he has accomplished this under disadvantages, we honor him the more.—Editor.]

The production of electrolytic copper was attempted in 1879; in 1880 there was a small quantity made; up to 1891 the annual production was insignificant, but after that year the industry appears to have begun to get a good foothold. The first records obtainable start with 1897, and the following figures show the approximate output for each calendar year named: 1897, 250,000,000 lb.; 1898, 314,107,776; 1899, 386,410,356; 1900, 466,092,663; 1901, 477,954,569; 1902, 488,652,307; 1903, no record; 1904, no record; 1905, 760,000,000; 1906, 865,000,000 lb. These figures are interesting, as showing the rapid and steady development of this new branch of the copper industry; but this is not all, for in the refining of copper by the electrolytic method, a very large amount of the precious metals is recovered which under the old method was entirely lost.—D. Houston.

SKIPS AND CAGES.

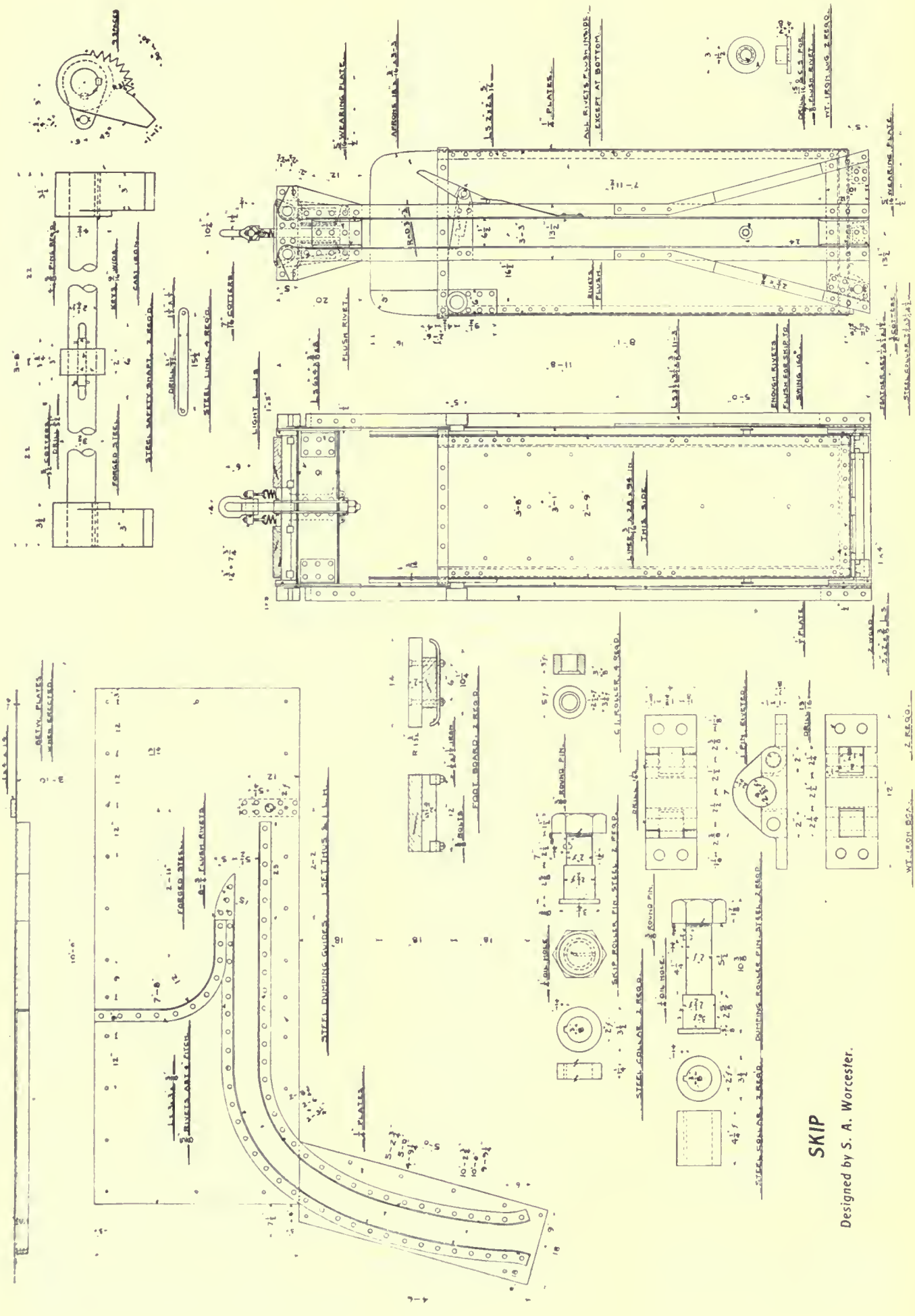
Written for the MINING AND SCIENTIFIC PRESS
By S. A. WORCESTER.

The prejudice, as I consider it, with which many mine managers regard the skip, as compared with the cage, as a device for hoisting ore economically, leads me to make a specific comparison of a number of the important features of the two devices, in practical operation. First, in the matter of loading, when an ore-car is dumped directly into the skip by hand, the time consumed is usually much less than is required to remove an empty car from a cage and replace it with a full one. In cases of large tonnage, such as to justify automatic apparatus for caging cars, a skip, with a special filler of proper construction, will load in less time than is possible with the cage. The filler that I have in mind is an ore-pocket having a capacity of exactly one skip-load; where bins are used for loading the skip, this filler is placed at the gate of the bin, and is filled from the bin while the skip is making a trip. This filler has a large gate or door, which is simply unlatched and swings wide open, so that not more than two seconds are required to fill the largest skip. There is no danger of over-filling, because the filler contains but one skip-load; and no time is lost by rock jamming in the door, because the filler is entirely emptied each time the skip is loaded. A variation of several inches, in some cases a foot or more, is allowable in the height of the skip when loading, but the cage must be landed carefully on chairs or landing dogs before cars can be changed. The repairs on cages and chairs, when operated to large capacity, are immensely greater than for skips doing similar work, and this is largely on account of the necessity of stopping on chairs. The loss of time at some mines on account of frequent damage to cages and chairs is something enormous. One of the most common accidents is caused by chairs being left projecting without the engineer's knowledge. On receiving the signal to lower, the engineer lowers the cage, perhaps at full speed, against the chairs, and the result is a bad wreck, and perhaps loss of life to an employee. The saving of time in unloading the skip is evident to anyone who observes and compares the working of the two devices.

For large capacity the skip should have at least four or five feet of head-room above the usual dumping height, so that it can be stopped anywhere within this range and dump itself quickly. By giving the dumping guides an easy curve, resembling the parabola, the dumping operation can be performed with great speed and safety. For rapid work the skip should be tilted to perhaps 60° from the horizontal, so that the ore will run out rapidly and no fine stuff will remain. With proper arrangements, the dumping operation should not require more than 10 seconds for the largest skip, counting all of the time that the skip is tilting, stopping, and returning to the vertical position. 'Caging' cars at the surface is nearly as slow as in the mine, and even the best automatic arrangement is slower than the skip, because the cage must be stopped twice, first above, then gently on, the landing chairs, and if double-decked or three-decked, a landing is necessary from each deck.

The cage, as ordinarily used, necessitates surface trammers for taking the ore to the ore-house, but the skip is easily made to dump into any one of a number of bins, by using suitable spouts or deflecting doors, thus eliminating tramming. While it is true that a skip requires a higher head-frame than a cage, the extra cost is soon repaid by the saving in labor and repairs and the increase in capacity. The capacity of a skip may be increased almost indefinitely by simply increasing its depth, and this without requiring any longer time for dumping, also without increasing the time of loading, when the filler is used. The skip herewith illustrated was designed for the No. 1 shaft of the Findley mine, at Cripple Creek, Colorado; it displaced the two-decked cage that had been used for some years. When using the cage, two trammers were employed on each shift to move the ore a distance of perhaps 30 ft. to the ore-house. They had separate tracks, one above the other, so that both decks were unloaded at the same time. The engineer, cager, and trammers were constantly busy, running the plant up to the limit of capacity. Accidents to cages and chairs were frequent, annoying, and expensive, with their accompanying delays. The skip now in operation hoists four mine-cars, or two cage-loads of rock. The trammers are dispensed with, the skip dumping into any one of four bins, as the ore is directed by deflecting doors. The head-frame was extended 32 ft., bringing the sheave-centres 92 ft. above the collar of the shaft. Soon after installing this arrangement it was found that the capacity of the plant had been more than doubled, so that while the mine was shipping exactly twice its previous tonnage, the hoist had frequent short periods of rest, and was not crowded to the limit of speed as before, when hoisting, and the operation of the plant generally was much smoother and freer from accidents and delays.

One objection frequently urged against the skip is that it is not so convenient as the cage for handling men, timbers, etc.; in this case the objection is overcome by making the skip-frame in the form of a cage, from which the box can easily be detached and hung completely out of the way, in a few moments. It can also be replaced with equal celerity and convenience, by one man; the removal of one spring-cotter from the pin-keeper enables the cager to draw back the pins that hold the hinged caps of the boxes. The skip, resting by its wrought-iron lugs in the skip-hangers, is then pushed easily back to the detached position, to remain until it is again needed. The shaft being small and not very straight, and the hoisting speed 1500 to 2000 ft. per min., the skip is made deeper than is usual, in order to obtain the required capacity. The latches absolutely prevent the skip-box from tipping out of position and encountering the shaft-timbers. The hinged box-cap before mentioned was suggested to me by observing that a cap used for a similar purpose at another mine once dropped to the bottom of a 1400-ft. shaft, into 75 ft. of water, and the skip was put out of commission until a new cap was made. I therefore avoid



SKIP

Designed by S. A. Worcester.

this danger by having loose no more important part than a spring cotter. This could be temporarily replaced by a nail or a piece of wire, if lost. At this mine the car is dumped directly into the skip. It will be noticed that the springs operating the safety-dogs are placed inside of the framing and thus protected from damage by the car when loading the skip.

The original cost of a plant for skip-hoisting, including an excavation for a pocket at each level, is much less than that of a cage equipment, including the necessary large number of cars and the excavation for double tracks at each level. One car only, for each trammer, is required where bins are used at the levels, and the excavation for bins is not over one-fourth of that required for double tracks for cars, for a given capacity. Where unbalanced hoisting is practised, the proportion of dead weight of cage and car or cars, or of skip, to the ore hoisted, is a matter of importance, as affecting the power consumption, as well as the speed and capacity of the hoist. The weight of the Findley skip, although heavily lined and substantial, is several hundred pounds less than that of the double-decked cage and two cars which it displaced, although it carries twice the ore-load. The objection that the skip is inconvenient for handling men and supplies, is overcome, in some cases, as, for instance, in a plant that I designed for a Telluride mine, by carrying a cage a short distance above the skip, so that the cage-floor aligns with the level when the skip is at its loading position. Where, as in this case, balanced hoisting is invariably used, the item of weight of cage adds nothing to the work of the hoist, except a little friction, and is not objectionable.

At some mines it is considered important to hoist each car of ore separately, accompanied by a trammer's tag, specifying the particular bin for which it is destined. In nearly all such cases it is perfectly feasible to use several skips in one frame, all dumping simultaneously, but each into its own particular spout, below which is placed a car. They can also be loaded at one setting, by using properly arranged spouts, thus avoiding re-setting, which would be necessary if the skips were loaded singly at the level. Little ingenuity is required to devise an arrangement that will handle the trammers' tags with greater safety than at present. It is also a simple matter to direct the ore to different bins by using deflectors, as at the Findley plant, or by using dumping guides at different heights in the head-frame, and so arranged that any set can be switched into or out of line, to dump the ore at different heights and send it in different directions. Mining operators are gradually awaking to the merits of the skip, which in its early forms was an old Cornish device, but even at this late date is not nearly so well known and generally used as it should be.

Cupellation losses are due to absorption and volatilization. The loss of gold and silver depends upon the temperature of cupellation, the amount of lead with which the gold and silver is cupelled, the physical condition of the cupel, and the nature and amount of the impurities present.

Freight Traffic.—Few people have any definite idea how fast railway freight actually moves. The layman's idea about the matter would probably be something like 20 miles an hour. But the truth is that there are not a few lines on which 20 miles is a good day's journey for railway freight to make. That is what James J. Hill reported as the average rate on his roads in hearings on the subject of car shortage, a year or more ago. Meanwhile there have been numerous complaints of lack of promptness in furnishing transportation facilities for livestock shipments in the Southwest. In connection with this inquiry the Interstate Commerce Commission collected definite information on the subject. The result of the inquiry is that the average distance reported for freight cars, for 14 roads west of the Mississippi, was 29 miles a day in 1906. The average in 1900 was 31 miles, or a reduction of 6.4% in six years. The figures below represent several of the leading transportation systems, and may be taken as fairly representative of conditions in their territory:

Roads.	1900	1906
Great Northern	28	28
Northern Pacific	28	31
Burlington	34	32
Missouri, Kansas & Texas	37	24
Rock Island	30	27
Southern Pacific	34	34
Missouri Pacific	20	17
Texas Pacific	38	27

Is it probable that these averages represent decreased efficiency of the freight service, such as President Mellen had reference to when he accounted for the backward trend of railway business by saying that labor had probably lost a quarter of its efficiency within the last half a dozen years? The explanation given by livestock shippers is that the railroads let their cars stand idle while waiting for additional cars in order to make two engines in so many trains do the work of three under earlier conditions. The result of this effort at economy has been to overload engines, increase breakdowns and accidents, and greatly reduce the promptitude of service. Numerous complaints have been presented of livestock shipments over long distances in the Southwest and West, which did not average more than from 4½ to 10 miles per day, thus increasing the expense of caring for the stock 100% and causing much loss of weight in the condition of livestock. Such figures as these certainly look as if somebody had lost the grip on railway transportation.—*Boston News Bureau.*

Tellurium is tenacious in its hold on gold and silver, and if a high-grade telluride ore be assayed, even by special method, the beads from cupellation will frequently contain tellurium. In the crucible assay the slags absorb gold, and owing to the presence of tellurium in the lead button, gold is absorbed by the cupel. A good flux for the ordinary silicious ores is made up as follows: potassium carbonate, 7 parts; sodium carbonate, 6; borax glass, 5.5; flour, 1; litharge, 30 parts. About 75 gm. of this flux is used with 0.5 assay ton of ore.

WELFARE OF LABORERS IN REDUCTION WORKS.

Written for the MINING AND SCIENTIFIC PRESS
By L. S. AUSTIN.

No manager or superintendent of a reduction works has a right to think himself a superior being, to whom the working man is to bow down, but rather as a trustee responsible for the proper use of the human instruments under his charge. Like him, they have self-respect and feelings that are to be considered, and yet the things which he thinks a comfort and an advantage, may not appeal to them. He must therefore study their ways sympathetically, though critically, and put himself in their place. Thus he will increase their efficiency, add to the interest of the men in the work, and avoid strikes, to say nothing of the humanitarian aspect of the case. If his men have confidence in his ability, in his desire for their welfare, it will go far to bringing about economical results.

A reduction plant is essentially a manufacturing establishment where metals are extracted from ores, or where the crude metals are refined, hence the principles underlying the organization and management of factories, of which so much has of late been written, is applicable to reduction works also.

There are two considerations to be regarded, first the purely commercial, which is interested in the largest tonnage at the least cost, and which involves not only cheap operation but efficient machinery, apparatus, and furnaces; secondly, the combination of this with a provision for the moral and physical welfare of the men with the view to retaining them, and making them more efficient and more satisfied with their work. Not much has heretofore been done in the latter direction, but managers of such plants are having trouble in times of scarcity of labor (which are also prosperous times) in retaining their men. At other times labor may be cheap, but it is then possible to make it also more efficient.

As far as improved factory surroundings go, a beneficial effect can be exerted upon operatives who have been accustomed to a lower way of living where the surroundings are only those demanded by law, and have fostered objectionable habits, disregard of the value of property, contempt of authority, and opposition to the plans of the projectors of the improved order of management. As far as reduction works are concerned, they usually grow with the increase of the supply of ores, without increased provision for the welfare of the men. Conditions have been no more settled than those of mining, and the temporary aspects of surroundings such as one sees in the typical mining camp reflect the temporary aspect of such enterprises.

But this condition of affairs, with the evolution of more permanent conditions, can hardly be good business, and the amelioration of conditions has been taken up to a varying degree in plants, even of the same company. Thus, we find near the new Garfield plant of the American Smelting & Refining Co. a town with comfortable houses and well stocked stores, erected for the benefit of employees. The plans, when carried out, will make this settlement as desirable almost as that of the nearest city, 18 miles away. On the other hand, we find the surroundings of another plant of the same company so bad that only the most indifferent labor can be secured, and even that must be carefully nursed and catered to, at the expense of discipline. Where foreigners have been obtained for work about such plants, the company has sometimes furnished them quarters where they were herded by the hundred, and where their sanitary conditions, as well as their diet, have been of a nature to keep down their efficiency, their intelligence, and their comfort.

The companies permitting these conditions are not altogether to blame, since they do not in many cases know how bad conditions are, or again, they feel that the problem of amelioration is rather a hopeless one. Then again, the demand for good dividends makes them unwilling to invest money in improvements.

Still, the problem must be tackled. Labor-unions are making their demands for higher pay, and, in some degree, recognize and appreciate improved conditions. A reduction work can well afford to study conditions in order to make progress. For example, where foreign labor is employed, their food is not sufficiently nutritious, and their physical performance is low. If the company were to introduce soup kitchens, where soup, bread, and well cooked beans and meat could be procured at a low price (as cheaply as could be had at home), made palatable at the same time, we would find the men better nourished and more vigorous. This is well illustrated by Mexican labor in the Southwest. In Mexico we find the labor most inefficient; near the border within the United States the same laborers, because of better food, have become more efficient, and as we go northward the quality improves among the American-Mexican population.

As an example of what has been, and what can be undertaken, in this way, let us consider the work of Robert Owen at New Lanark, Scotland, in 1799 —over a century ago—but with bitter opposition on the part of the people he benefited. Large families had been crowded in wretched hovels, and the filth was beyond description. He at first provided each workman and his family with two rooms to live in, and then cleaned up the streets and encouraged cleanliness in the homes. Schools were unknown there; he started them. He provided a hospital, a sort of club-house for dancing, music, and entertainments, a kitchen and an eating-house, a wash-room properly equipped, a library, and a lecture-hall. Stores were at the same time opened, where superior goods were to be had at moderate prices. Finally, a ten-hour day was introduced, and child-labor largely reformed. In spite of the opposition of his partners to his plans, Owen's business succeeded amazingly, and paid increased dividends, so that he retired at the age of 58 a wealthy man.

Today we find a general disposition to recognize the normal obligation of the employer to the worker, and the feeling that it is good business to treat the employee decently. One can find manufacturing establishments where safe, comfortable, and even

attractive surroundings are given, as also facilities for recreation and for mental and moral development.

The most important consideration, from the point of view of the business man, who is becoming interested in the problem, is that it pays dividends in spite of the capital that must be used in providing these improvements. One factory employer, indeed, in summing up his experiences, says: "One of the most profitable investments that can be made in a manufacturing plant is to give the largest possible advantages in the way of conveniences and sanitary arrangements. Every kind of legitimate comfort and convenience that may be provided for operatives is a source of profit to the employer, although apart from the moral obligation to care for the health and comfort of the employee." Another employer, doing a large business, who had improved conditions and surroundings, being asked if it paid, said: "Three years ago we had a standing advertisement for help wanted in every paper in the country, and then could not get enough. Today there are upward of 100 applications on our waiting list. Last year, with 60 people less on our pay-roll, we did a business of $20,000 more than the year before."

Experience, as far as manufacturing establishments are concerned, goes to show that from the contentment, intelligence, and willingness on the part of employees, the employer himself gets a greater advantage in the way of economical output and increased profit. It must be admitted that there are many employers who yet manage their business with minimum consideration for their work-people, and who declare they have a sufficient supply of labor, but with them there is always more or less conflict with employees, and in times of prosperity, when they should be making their greatest profits, they are held back by a shortage of labor.

It is these principles, applicable to the factory, that may be used in the management of reduction works. Let us see then how they may be applied: In the first place, we have to decide who should give attention to these matters. A large concern might afford to have a man appointed as a welfare-manager, or a company having several plants could appoint one in an advisory capacity to visit and inspect the different plants. However, at any individual plant, ultimate control must be held by the superintendent, who is obliged, for greatest effectiveness, to keep in touch with his men. To make these improvements must then devolve upon him, or upon an assistant whose duties involve the responsibility for details, always under the supervision, with the approval, and in consultation with, the superintendent. This officer is the only proper one. For the business manager to step in and interpose his authority would lessen the contact of the superintendent with the men, where, for efficient technical control, he should know those who are to carry out his plans. Upon the assistant then will devolve this welfare work in addition to, and supplementing, technical duties to which he gives chief attention. The question might arise whether such a man, while good as a metallurgist, might not be successful in this work. It can be replied that it should be possible for him to learn; and again, since he is in order of promotion to the superintendent's place, he must learn those duties which the superintendent successfully supervises and controls. The chief must also realize the importance of this work, and not set it aside as secondary to output and operation. Dissatisfaction and strikes are to be headed off by precaution, rather than fought after they come. Shutting down a plant does not stop general expenses, and certainly does stop profits. It reflects upon the company, and upon the superintendent, whether justly or unjustly, and the reputation of the latter depends, not only on technical execution, but also on the management and efficiency of his men. Hence he must not only attend to their welfare, but he must go among, and get in touch with them.

Such work for the welfare of the men naturally divides itself in two: those for his comfort during working hours, and those during his hours of rest and recreation. The first division is closely connected with operation, and is chiefly watched by those in charge, who see that they are properly used; and the second group needs, in addition to the cost of erection and maintenance, the co-operation of the men benefited.

Referring to the first group, I shall first take up the consideration of protection from accidents incidental to the use of machinery. Platform-elevators should be regulated by automatic stops, since they are operated by the common laborer; self-closing gates also should be supplied at the landings. Gearing must be covered, and belts and pulleys, where they are liable to be touched, guarded by a safety-rail or cover. Belts should be kept in good repair as regards lacing. Holes in floors, such as those for stairs and hatches, are to be railed in, and temporary holes covered promptly when not in use. Shaft ends, liable to catch clothing, should be guarded and safety-collars used. In general, the machinery should be so protected that the careless and the ignorant are prevented from getting hurt. Signs, printed in a language understood by the men, are to be posted, and they both give warning and protect the company against legal consequences.

Lighting the plant, not only adds to the efficiency of the men, but to their comfort. Additional windows can often be put in, and white-washing the interior surfaces is a great help. Paint also adds to durability, as well as lighting, and both it and white-wash can be of a nature to lessen the chances of fire. Ventilation is a thing that is often sadly neglected, even in recently designed plants. This is particularly true of works treating sulphide ores. Sulphur fumes escape into the building, when by improved hood and liberal exit-flues much of the trouble can be obviated. Even after the fumes escape, their discomfort can be greatly lessened by liberal ventilation. In situations like that of a crane-operator it should be possible to give a special supply of fresh air.

Heating is often neglected about a metallurgical plant, and operatives are exposed to the weather, so that they suffer more than they should, and use

part of their time in trying to keep warm instead of working. Such men work in excessively warm places, and in cooling off are exposed to drafts and damp, with great risk to themselves. Indeed, heating and ventilation go hand in hand. In summer, windows are needed for ventilation, in winter they are closed to retain the heat. Then it is that special provision is to be made for ventilation without losing much heat. In front of furnaces the fumes from the tap-holes can often be collected by hoods, and these carried by a common pipe to a suction-fan. Where there is much dust, the bag-house has been introduced, primarily for the saving of valuable material, but incidentally greatly adding to the comfort of the men. Where ore is crushed dry, the dust is often thick, annoying, and obstructs the sight. Machines that produce it should be cased in and connected to a central fan-system, and thus the building freed from all the dust practicable. It costs to keep a place clean, and yet it pays in many ways to do so. A slovenly establishment is a reflection upon its superintendent, and causes slovenly work or waste. A reduction works in disorder, with tools lying around or forgotten in corners, is wasteful, because these things are practically lost. Where dust and filth are allowed there is discomfort to many of the men, and those the best ones. Smooth walls (easily painted), concrete floors, and well-laid common floors are more easily swept, more easily traversed by wheelbarrows. Wooden floors should be double, for convenience of repair, and are then also tight.

Cleanliness in the person of the workman is to be desired, and yet in many metallurgical operations it is hard, in fact, impossible, to keep so. Nevertheless, a struggle should be made to minimize such discomfort. For the bag-houses above alluded to, helmets carrying a supply of fresh air are to be had which enable men to go into such places without risk of life. If dirty work cannot be avoided, at least proper means for washing after work should be put in. In so many places one sees buckets standing round, which each workman takes time, during his shift, to fill with water, often obtained at much inconvenience and loss of time to the company. An improvement on buckets is a long trough supplied with hot and cold water. Even this is not satisfactory, as men object to washing in a common water, and individual wash-stands, such as those seen in railroad stations, are to be preferred. The men furnish their own soap and towels. A simple installation consists of ordinary enameled wash-basins, so arranged that they may be tipped into a drain-trough below. The bowls and their surroundings should be kept in order, and in repair, and be cleaned up constantly by the janitor or his assistants. The men should have a ventilated wooden or metal locker to put their clothes in, instead of hanging them up anywhere, at the risk of being injured or stolen. These lockers are often heated below the bottom by a steam-pipe running underneath, thus drying the clothing that may have become damp.

Many metallurgical operations are dusty and hot, causing sweat. Men working at them need a bath at the end of the shift. For this the shower bath, having both an upward and a downward jet, is the most satisfactory. The bather stands on a wooden grating and the dirty water entirely escapes. Probably a fixed supply at a comfortable temperature would be most satisfactory, otherwise water should be left running. This can be furnished from a flushing tank, as in a closet. Above anything else, proper attention should be given to the matter of suitable closets for the men. Great attention should be given to building them so that they can be easily cleaned: they should be semi-private, that is, divided by partitions, and watched to prevent misuse. The simplest accommodations are good enough, provided there is cleanliness and proper sanitation, as well as a degree of privacy. The place should be so that it can be washed out with a hose.

Men who feed furnaces have periods of rest and of labor. So long as they keep the furnace supplied they can take rest as they please. For them some provision should be made, as comfortable benches in a comfortable place, especially in cold weather. These places may well be where they can still have their work under supervision. One of the most unsatisfactory, and at the same time difficult, problems is that in relation to the noonday lunch of the working-men, and especially that of the inside men about reduction works. A man must give attention to his duties, which may call for his total time during the noon hour, and must find time to eat his lunch as he can. In works reducing lead ores this is especially detrimental. Food carelessly eaten with dirty hands transfers lead-bearing dust to his digestive organs and results in lead colic. The man cannot go far from his work, and indeed in a large plant this will take time and effort. Let us consider what has been done at other industrial establishments:

At some establishments places have been provided for the officers and foremen for a noon-day meal, when such facilities were lacking near-by. These places are fitted up by the company and run without profit, the finances being in charge of one of the office force in addition to his regular duties. This, however, does not take care of the working-man, who at noon takes advantage of the nearest saloon, adding beer to his regular food. The beer, after its temporary stimulus is gone, makes a man apathetic, and diminishes his capacity for work during the rest of the day. The alternative is generally sitting upon some pile of material, or on a bench, and hastily eating his meal with dirty hands. Such conditions detract from a man's self-respect, and he is disposed to resent it, even if he says nothing. If something better than this is to be provided, a room, or in a large plant, several of them, can be furnished with plain tables and chairs. These places must be kept clean and swept out, or else they will become disused; that is, unless they excel the old method, the workmen will not use them.

A favorite plan is an arrangement to sell good hot coffee, bread, or soup at a low price. Two cents for a cup of coffee with cream and sugar will pay its cost. This is taken with their lunch brought from home. The price of the food sold him, as well as its quality, cuts quite a figure to the working-man, and

since his attendance is purely voluntary he must be catered to. Another plan that works well is the delivery of 10-cent lunches by some outside concern, which at the same time is willing to sell smaller quantities as needed by the workmen, such as coffee, milk, or bread. This is delivered to the men by distributing wagons, which appear about the works promptly before the noon hour. The 'cafeteria' scheme is another way, and is excellent when men get trained to the method. Each man helps himself, under proper control and check, and takes a chair with a broad arm on which his food rests. It lessens the cost of attendance and expedites the work at the rush hour, and has been found to work well. That the men specify what they have taken or what they owe, is an additional training, putting them on their honor. The watching of the men is unobtrusive, and a cheat will be found out after a little while: in fact, the service should conduce to good-will on both sides.

The question of water-supply is important, especially for men working in the heat. The usual way is to supply barrels, from which the water can be dipped out by a cup. A freely running tap from which the water can be drank without a cup is better, but it should be cool. Again, water is stored in barrels, to which ice is added, and the water drawn by a faucet. For men having hot jobs, water alone does not seem to be so satisfactory as that where oatmeal is used, half-a-pint to a barrel of water. This also diminishes the desire for beer. The barrel should be cleaned out, and fresh oatmeal added daily, it being placed in the water in a muslin bag.

Regarding the attention to be given to facilities for rest or recreation, much can be done. The plant may be in some out-of-the-way place, and the company may have to operate its own boarding-houses. To give satisfaction here the food should be in abundant supply (but not wasted), should be digestible and palatable, that is, well cooked and well served, and, while avoiding needless variety, should consider the former habits of the men. The statement often made by mine managers, that good food is the greatest attraction and one of the best means of holding the men, is quite as true for the employees of reduction works. It should be the duty of the superintendent to look into this, to take an occasional meal with his men, and thus find out how they are looked after. Provision has been made by some companies, and especially by mining companies, for their married employees by furnishing them houses, commonly built in long rows and strictly on the same plan. Variety in the style, and in the size of these houses, should be introduced, to suit the families that occupy them, and more attention should be given to make the surroundings attractive. Here again comes in the work of the welfare manager, who is an expert in such matters, and who can see that such plans are carried out in an efficient way, and then turn them over to the charge of the superintendent.

The indirect influence of cyanidation in stimulating mining exploration has exceeded its direct service to the industry.

Pocket Mining.

All the rich spots are not in Nevada. In California there have been many fortunes dug out of a space no larger than a living-room, and from some of the larger 'pockets' some splendid masses of gold-quartz have been extracted. Thus, in July and August, 1881, the Rainbow mine near Allegheny, in Sierra county, yielded $95,482, besides a lump of ore weighing only 200 lb. but estimated to contain $21,180. All of this money, that is, $116,622.88—to be exact—came from 1962 lb. or less than one ton of ore. The lump was sent to Johnson & Matthey, the London assayers, and they returned over $23,000. But pockets are like a donkey's galop, short and sweet. H. H. Noble worked this mine for 22 years after that 'bunch of ore' was taken out of it, but without 'seeing a color,' until 1905, when some more rich stuff was found. In February, 1906, a shipment of bullion worth $11,600 was made, and the mine is now doing well. A few days ago another pocket was struck. The bonanza mined in 1881 was 130 ft. long and 180 ft. deep. All of it was milled. Outside of the specimen stuff, most of the vein was hungry-looking quartz, that assayed from $1 to $30 per ton. It was discovered when driving a bedrock tunnel under a gravel deposit. The 'pocket' was simply a rich spot on the foot-wall of a poor quartz vein, 4 ft. wide. There was no cross-vein or fault at the enrichment. On being driven out by an excessive flow of water, the owners drove a 3000-ft. adit to cut the vein 500 ft. under the former workings. Where the vein was finally intersected it was merely a barren stringer. A raise was started and this eventually reached the upper workings, where $5000 was extracted from ore left in the old stopes. Just below this level the vein was shattered, and if the owners had sunk a few feet deeper (before being driven out by the water) they would never have made the long adit.

The Tightner mine is adjacent. H. L. Johnson extracted $65,000 from one ton of ore taken from this mine. Subsequently, in 1906, he bonded it to Senator John P. Jones and his brother. They were to pay $100,000 in cash and $100,000 in deferred payments. Being disappointed, they never completed the transaction. Johnson went to work and took out $200,000 almost immediately. Such is mining in a pockety gold vein.

Lyons is an important centre for the electro-chemical industries, about 100,000 hp. being used. For the production of aluminum 35,000 hp. are used, for that of calcium carbide 25,000, and for chlorates 15,000 hp. The power employed for electric steel furnaces and the manufacture of ferro-alloys is 22,000 hp., while 3000 hp. are used for other chemical manufactures. More water-power is being developed and a marked increase in these industries is expected.

Of the many oxidizing reagents used in cyanidation, only a few have been found to have any practical utility.

EARTH MOVEMENTS AT BUTTE, MONTANA.

Written for the MINING AND SCIENTIFIC PRESS
By R. H. CHAPMAN.

*In 1904 precise level lines were run at Butte, Montana, and some 18 bench marks located. This work was done to establish reference points for drawing lines whereby to detect the changes in levels due to the caving of the extensive underground workings.

A line was run about four miles north and south across the undermined area and benches established at the ends, one in the flat south of all workings and one in the granite on Walkerville ridge, well to the north of extensive workings at that date. An east and west line extended approximately two miles from Meaderville to a point near the Big Butte. In addition, a circuit of about 10 miles was run northeastward to Elk Park pass, and a tie made to a bench mark of the work of 1896. To this earlier work, and also that of 1899, I shall refer later.

In 1906 the Coast and Geodetic Survey brought a line of precise levels from the southwest (Pocatello, Idaho), and tied to several of the benches of 1904 (9 in all).

Beginning at a point near the Butte Reduction Works, in the flat south of the hill on which most of the mines are situated, and running northward, the following differences appear:

		Ft.	
1.	Butte Reduction Works B. M	0.000	¼ mile
2.	Webster School	0.017	1 mile
3.	Colorado St. School	0.051	
4.	Owsley Block	0.436	
5.	Courthouse	0.737	1.5 mile
6.	Government Building	0.888	

This line shows an increasing subsidence in the benches as they are nearer the extensive underground workings.

A second line shows a similar condition:

		Ft.
1.	Butte Reduction Works	0.000
2.	South Butte B. M	0.051
3.	Braund House	0.130
4.	Florence Hotel	0.791
5.	Government Building	0.888

The above figures give a subsidence for the two years (1904-06):

Owsley Block.....0.218 ft. per annum
Courthouse.....0.368 " " "
Government Building.....0.444 " " "

This shows a differential of:

0.150 ft. between Owsley Block and C. H.
0.076 " " C. H. and Government Building.
0.226 " " Owsley Block and Government Bdg.

The comparison between the work of 1896 and 1899 and that of 1904 cannot be relied upon with the confidence given the later figures, but it is found that between the years 1896 and 1904 the Courthouse had sunk 0.895 ft. with reference to the Owsley Block, which must itself have gone down to some extent during that time. This change is at the rate of 0.112 ft. per year. The total subsidence at the Courthouse from 1896 to 1906 is undoubtedly as much as 1.632 ft., which is at the rate of 0.163 ft. per year.

*Published by permission of the Director, U. S. Geological Survey.

The long circuit of 1904 to the eastward was run from Butte across the line of the great structural fault of the Rocky Mountains, and a reference bench mark set on the east side of this fault-line. By combining the earlier work (1896-99), and comparing it with the results of 1906, some interesting figures appear:

Between Owsley Block and Elk Park Pass B. M.
In 1896 ..... +663.161
In 1904 ..... +663.839

an interval of 8 years, with a change of +0.678 ft., most of which is accounted for by the sinking of the Owsley Block, but by indirect comparison between the Owsley Block and a bench mark to the west (combining work of 1896-99, and applying a subsidence correction for the Owsley Block), it is found that the Owsley Block has changed —0.551, and the difference between this and the +0.678 obtained from Elk Park B. M. gives a difference of 0.127, more than a tenth of a foot for possible movement along the fault-plane in 8 years. This figure is of doubtful value.

During the work of 1906, in conversation with Mr. H. V. Winchell, he said that he hoped that by frequent re-running of the level lines we would be able to determine if movement is continuous along local fault-planes and the continental fault of the range, and to measure any such movement found. The figures given cannot be accepted as final, but they show changes of such magnitude as to renew interest in the work already done and to offer a basis for additional work for more complete comparisons. It is hoped that the levels will be repeated at short intervals in the future.

Comparative tests of shoes and dies of different kinds of steel have been made at Lucknow, N. S. W., ranging over a year's milling of 10,000 tons. Cast-iron and chrome steel were compared, with the following results:

	Life, weeks.	Duty, tons.	Wear per ton milled, lb.	Wear per shoe, lb.	Cost per ton milled, d.
Cast-iron	8	79.95	1.201	96	2.730
Chrome steel	32	319.78	0.419	134	1.816

The above tests were made with steel imported from Germany, and subsequent tests were made with English chrome steel castings, and in every instance the English steel proved superior in duration and cost, the margin being small in the former particular but over 10% in the latter. In the above tests the value of the discarded shanks is credited to the cast-iron shoes, but not to the chrome steel scrap, which was useless for the local foundry. Chrome steel when first put on the market for milling fell into disfavor locally owing to the inferior grade of castings supplied.

The success of an industry is not furthered by the maintenance of unscientific secrecy, but rests rather on the broadcast dissemination, among progressive nations, of accomplished truths, on the reciprocation of enlightenment, on the exchange of valuable knowledge—in short, on the scientific spirit of enterprise aided by international technical co-operation.

FLOTATION PROCESSES AT BROKEN HILL.

Written for the MINING AND SCIENTIFIC PRESS
By an Occasional Contributor.

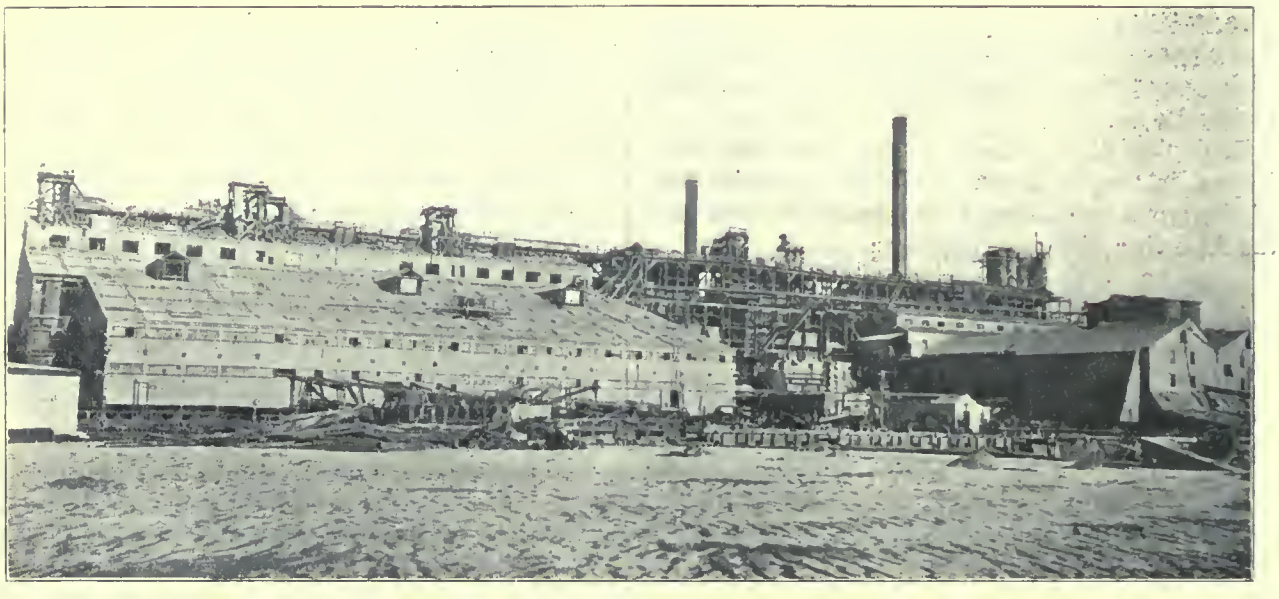
Minerals Separation Ltd.—This company's processes have their greatest development on the Central mine of the Sulphide Corporation. There are four plants here, with a total capacity of 2000 tons per day. One of these plants treats 500 tons per day of pure slime, with an extraction of 87%, producing a concentrate that assays 36% zinc and 30% lead. The plant is now closed down because of the low price of lead. The other three plants treat 500 tons per day each of tailing and slime mixed as they come from the lead concentrators, and, with an extraction of 85%, produce a concentrate assaying 47% zinc and 10% lead. This process (erroneously called the Cattermole) was tried by the Zinc Corporation and thrown out as a failure.

Potter Process.—Since the consolidation of the Delprat and Potter interests, the Delprat process has become a thing of the past. The Broken Hill Proprietary is using the Potter process only. The tailing from the Wilfley tables, mixed with re-ground material from the dumps, is washed clear of slime, and is fed to Potter pans 9 by 9 ft. at the top, and 16 ft. deep, where it comes in contact with strong acid solution. The extraction of the zinc is said to be 90%, in the form of a concentrate assaying 40% zinc. The plant treats 1200 tons per day at present, but an enlargement of capacity is being considered. There is a persistent rumor at Broken Hill that the Proprietary is using two tons of oil per day in this process.

De Bavay Process.—This is in use on the Broken Hill North mine. The tailing from the lead-mill is washed clear of slime and sized to eliminate all material over 60-mesh size. This washed and screened material is delivered to an A. Z. Clark agitator, which takes 15 tons of material to the charge. After agitation with water an acid wash is added. This acid wash consists of a weak solution of sulphurous acid made on the ground, to which is added 5 to 10 lb. per ton of tailing of strong sulphuric acid. After agitation is complete, the tailing is transferred to a pressure-vat, where it is agitated under an air-pressure of 60 lb. per sq. in., and an oil emulsion is added to aid subsequent flotation. From this vat the aerated and oiled pulp is forced by pressure to the head of the mill, where it is run into storage-hoppers. From these hoppers it is fed in a thin stream onto inclined tables, where the oiled and aerated mineral floats off and the gangue sinks. These particulars are well guarded, but the fact that an oil is used to aid flotation in this process is admitted by those in charge of the plant.

Elmore Vacuum Process.—After the failure of the Minerals Separation process, the Zinc Corporation adopted the Elmore process, and it is expected that the new plant will start in March. The preliminary testing has been very favorable, and indicates that the Elmore machines will have a capacity of 25 tons each per day. There are 16 machines being installed, thus giving a capacity of 400 tons per day. It is proposed in this plant to re-treat the concentrate by roasting off the oil, and then concentrating on Wilfley tables to recover a portion of the lead. The total recovery and grade of concentrate produced in this plant will be much the same as by the Mineral Separation processes on the Central mine. The Pinnacles Elmore plant has been closed down by reason, according to the manager, of high costs and low extraction. He says they will put up a new wet-table mill and abandon the Elmore process.

Gillies Process.—This process on the Block 10 mine has been abandoned because of high costs and low extraction. There was some discussion of adopting the Minerals Separation process in this plant, but the plant was not adapted to the scheme and it was not carried out.



Concentrating Mill of the Broken Hill Proprietary Company.

Talcose or clayey ores when crushed for cyaniding make a great deal of slime which is exceedingly difficult to leach, and hence require treatment as a slime, adding greatly to the cost of extraction.

A METHOD OF MINING.

Written for the MINING AND SCIENTIFIC PRESS
By C. EVERARD ARNOLD.

In working the Union claim on the Smuggler vein during the early 'eighties, much bonanza gold and silver ore was mined and packed over the mountains by mule-trains to Sheridan Junction, being taken thence by rail to a smelter at Alamosa. As the ore was mined the stopes were filled with the vein-matter that was not sufficiently rich for shipment and smelting, that is, all material worth less than $100 per ton. Lately these old stopes have been leased from the Smuggler-Union Company by Messrs. Lindsley, Townsend, & Livermore, a firm of mining engineers and mine lessees, who have devised and applied a scheme whereby the stope-filling is mined profitably.

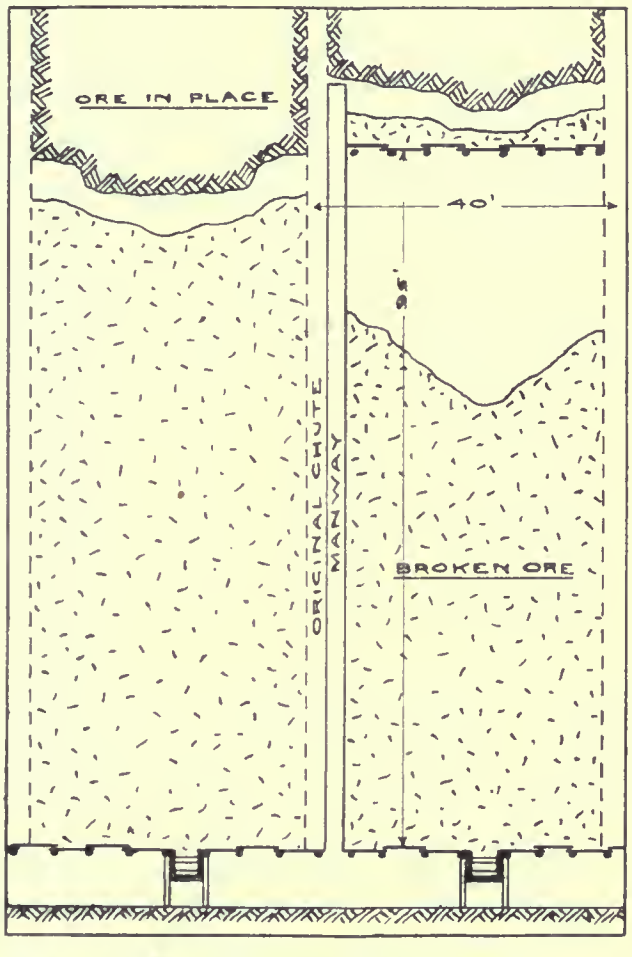
This pseudo-vein, as we may call the filled stope, strikes N 25° W, and dips 75° toward the west, having an average width of about 4½ ft. In appearance it is a gray soft agglomerated mass of quartz and country rock (andesitic breccia) fragments vary-

Smuggler, Colorado.

ing in weight from an ounce to 100 lb., these boulders being cemented together by means of the more finely shattered and clayey material of the original vein. Not least among the factors that enable cheap mining is the extent to which this ground will hold itself in place. Although soft enough to be mined wholly with a pick, a fairly sound stope-back can be maintained, provided it is always kept within reach of the miners.

In deciding on the scheme of mining to be used, the lessees fortunately had behind them the experience of having worked some of the old stopes farther north on the same vein by means of sorting underground and re-filling with the waste. Although, as pointed out above, the ore supports itself well, yet it was found that in mining thus the back of the stope would progress faster than would the level of the filling, so that as soon as control of the back was lost, not only were the lives of the miners endangered, but also in catching up the stope again considerable dead-work was necessary. This difficulty could have been overcome by using half-sets in conjunction with the filling, but the tenor of the ore, and the excessive cost of timber delivered in the mine, prohibited such an arrangement.

In the scheme now in use, sorting underground has been done away with. The original level, after twenty years abandonment, had caved to such an extent that practically a new level, timbered with 14-in. stulls, had to be driven, using the old timber whenever possible, and that was seldom. Chute-mouths were built 40 ft. apart, as it was found that the original chutes (indicated on the diagram by dotted lines) had been placed at intervals of 40 ft., and as they had rotted and crushed throughout their length and, moreover, were exceedingly difficult to remove, they were left in place, thus dividing the ground into 40-ft. blocks, in each of which stoping is now being carried on independently. Man-ways are maintained, beside alternate original chutes, and



Method of Removing Slope-Filling.

the stopes are connected, for purposes of communication and ventilation, by chopping holes through the crushed chute-timber.

In working these sections, stoping is begun at both ends and the two breasts carried toward each other to the centre, while enough rock is drawn from the stope to leave working space for the miners. After the two breasts have come together, a fresh bench of ground is stoped, and the process repeated until there is a depth of 90 or 100 ft. of broken rock resting on the lagging. Next a row of stulls is put in and lagged over, stoping then being continued as before, while the ore on the floor beneath is drawn out. Enough ore is left on the lagging to prevent falling rocks from breaking out any drift-stulls. When ore is needed from the floor above, or the stope becomes too crowded, the lagging is chopped out of a false set placed in the middle of the floor, and the ore runs through the emptied stope below. No lining or cribbing is used for the chutes, and no

shovelers are required until the stope is almost empty. As soon as the material is shoveled off a floor, the lagging is removed and used above, although these floors are not always removed, because it is found advisable to keep a reserve of broken ore in case stoping is delayed.

The ore is trammed by hand for several hundred feet through a cross-cut to an ore-house and dumped onto grizzlies (with 7/8-in. spaces) the undersize going directly to the ore-bins, while the oversize falls onto sorting tables. The waste is then picked out, the amount rejected constituting about 33% of the material mined. From the bins the ore is loaded directly into the buckets of an aerial tram, reaching the mill (1½ miles distant) in three stages, crushing taking place at the end of the second stage. Horse-tramming was tried between the stopes and the ore-house, but several costly wrecks occurred on account of a bad track, which cannot be advantageously altered during the severe winter weather, when the floor of the cross-cut is a mass of solid ice.

At the present time 235 tons of ore are sent to the mill every 24 hours. Disregarding the item of amortization and realization, the operating costs amount to $3.32 per ton of ore milled, this amount being distributed as follows:

	Per ton milled.
Stoping and timbering	$1.40
Underground tramming	0.28
Sorting	0.19
Surface tramming and crushing	0.70
Milling	0.75
Total	$3.32

Wages average $3.50 per shift. Taking into account the number of all the men employed at underground work and ore-sorting, the tonnage milled per man per day amounts to 3 tons; while under the system of sorting underground, referred to previously, this figure amounted to 1.7 tons.

Combustion, under conditions as found in the mine, of candles and lanterns will continue in air containing 3% carbon dioxide, if handled with great care, but they give very little light. Experiments made in an air-tight box provided with means for burning charcoal, while circulating the enclosed air and sampling it, showed that candles and lanterns were extinguished at once when from 3 to 3.5% of the oxygen was converted into carbon dioxide, and were extinguished by a very slight jar at more than 2%. An acetylene lamp continued to burn in still air containing a higher percentage of carbon dioxide than a candle would stand, but the flame became yellow and finally almost blue. At this stage it separated from the burner like a cap and was blown out by the slightest draft. Charcoal fires, even when a considerable mass was strongly glowing, ceased to glow when the carbon dioxide rose to about 7 per cent.

The price of aluminum was reduced to 22 c. per lb. on Jan. 1, 1908, by the international aluminum syndicate, which is composed of the principal producers in Germany, France, England, and America.

Decisions Relating to Mining.

Specially reported for the MINING AND SCIENTIFIC PRESS.

A miner injured by timber falling back upon him by reason of a defective chute was held to have assumed the ordinary risks of the business, but not any extraordinary risks, unless it appeared that he was aware of such at the time of his employment, or that, upon learning of their existence, he continued in the employment after the lapse of a reasonable time for the defects to be remedied or removed.

Leary *v.* Anaconda Co., (Mont.) 92 Pac. 477, Nov., '07.

Where a miner was injured by falling timbers caused by a defective chute, an instruction that it was the mine-owner's duty to provide the miner with a reasonably safe and sufficient rope and chute to hoist timbers from a mine, to make a reasonable inspection thereof, to keep the same reasonably safe, and to use ordinary care in so doing, was objectionable as placing too great a burden upon the mine-owner, and the correct rule was held to be that the mine-owner was only required to exercise ordinary care to furnish reasonably safe appliances and to keep them in a reasonably safe condition.

Leary *v.* Anaconda Co., (Mont.) 92 Pac. 477, Nov., '07.

The business of an employee in a mine was to work in a blacksmith shop on one side of a tram railway. The place where the drinking-water was kept was on the opposite side of such railway, and it was customary for the employees to go to such place for water. Such employee in crossing the tram railway while returning from getting a drink of water was injured by reason of negligence attributable to the mine-owner in operating cars upon such tram railway. The court held that at the time of his injury such employee was entitled to the same immunity from injury from negligence as when actually at work in the shop.

Woodward Iron Co. *v.* Curl, (Ala.) 44 South. 969, Nov., '07.

A miner of eight years' experience, and who had been head man in drill-work in a mine for over a year, was guilty of such contributory negligence as to prevent recovery for injuries from an explosion of dynamite where it appeared that he had knowledge that the bar with which he pushed and tamped the dynamite into its place was defective, and where he determined for himself the depth of the holes and how to put in the sticks of dynamite and used his own judgment as to the force necessary to get such sticks in place, and where he admitted that he was pushing hard on the dynamite at the time of the explosion, and he knew that pushing too hard would explode it.

Thornburry *v.* Old Judge Co., (Mo.) 105 Southwest. 659, Dec., '07.

No particular method of marking the boundaries is required under the statute providing that a mining location "must be distinctly marked on the ground so that its boundaries can be readily traced," and what is a sufficient marking may depend on the topography of the ground. In such case, it is a question of fact whether or not the lines are so marked that they can be readily traced by a person making a reasonable effort to do so.

Charlton *v.* Kelly, (Alaska) 156 Federal 433, Oct., '07.

Where a person, after filing adverse claim, sued in the State Court to quiet his title, under State laws, such suit was not affected by the statutes of the United States which provide that where an adverse claim is filed, publication of notice of an application for a patent, all proceedings, except the publication of notice and the making and filing of the evidence, shall be stayed until the controversy shall have been decided by a court of competent jurisdiction, or the adverse claim waived.

Bernard *v.* Parmelee, (Cal.) 92 Pac. 658, Oct., '07.

GEOLOGY.

By James F. Kemp.

*In all parts of the world, as we follow down through the successive layers of the fossiliferous strata, we find an ancient nucleus of crystalline rocks, gneisses, schists, marbles, serpentines, and minor varieties. The geologists who are now in middle life were quite universally taught by their instructors of twenty-five or more years ago, that the old strata were all sedimentary in origin, although now thoroughly crystallized and of vast thickness. Not a few believed that they represented materials which had been worked over many times by the ocean and the other forces of erosion. The prevailing banded or parallel arrangement of the constituent minerals was the proof of their sedimentary character. But today when we look back we find that we have greatly advanced from these views and that we hold conceptions which much more satisfactorily fit the observations. We know that the banded arrangement of the minerals, light and dark, is not necessarily evidence of sedimentation, but that it may have been produced by a pressure so great and irresistible as to cause the crystalline rocks to flow like viscous masses, and to drag and shear the minerals into long parallel leaf-like relations, suggesting indeed the bedding of sediments, but radically different from it.

While these conclusions have seemed inevitable to the observers in the field, yet at least one inquiring mind could not rest content until the processes had been artificially reproduced in the laboratory. By a brilliant piece of work and with the aid of elaborate and expensive apparatus, F. D. Adams, of McGill University, has first tightly encircled cylinders of Carrara marble in jackets of tough sheet iron. He has then submitted them to slowly but irresistibly increasing pressure. As the strain passed their limit of crushing resistance, and while they were so tightly encased in the tough, but yielding jacket, that they could not crack, they have passed from cylinders an inch in height to discs of half this altitude and of correspondingly increased diameter. Yet they have never lost their cohesion but have moulded themselves like so much wax. When removed from the jackets the discs are as solid and homogeneous as were the original cylinders.

These experiments are very recent, but Professor Adams is now continuing them upon other rocks such as granite; and instead of dry compression, now admits steam or heated water to the cylinder and seeks to reproduce in these respects the conditions of deep burial and metamorphism. In so far as the results have yet gone, they are a striking corroboration of the conclusions reached by observers in the field, among whom Professor Adams also occupies a most honorable place.

But we are likewise assured that banded or foliated structures may be original with igneous rocks. We have learned that molten masses in cooling and crystallizing sometimes separate into contrasted layers of light and dark colored minerals which may be brought by the conditions of eruptive flow into parallel relations suggestive of sedimentation but different from it. The field worker of today upon the oldest rocks therefore constantly keeps in mind the question, am I dealing with igneous or with sedimentary types? And the general result has been to prove in the areas of the oldest rocks a series of sediments indeed, but of greatly restricted amount and thickness as compared with earlier views, and to constantly abstract large fractional parts and prove them to be eruptive rocks, which have been forced through and between the ancient sediments. Vast masses of granite and similar types are now known, sometimes attaining dimensions of tens or even hundreds of square miles, which are later than the old limestones and sandstones, and which were regarded by our predecessors as one with them. On the whole the sedimentary antecedents of the fossiliferous strata have become much restricted in amount, and the time which they were once believed to represent has suffered diminution in a corresponding ratio.

At the close of the eighteenth century geologists well understood in a general way that the constituent strata of the earth could be classified in a systematic series of which some were older and some later. Soon after the middle of the last century the larger subdivisions were recognized, which we now call periods, and substantially the same names that we use today were given them. Geologists knew that before the appearance of life, or in the Archean times, there were the Laurentian and Huronian periods. During the era of ancient types of life, or the Paleozoic, there were six periods, respectively, the Cambrian, Lower and Upper Silurian, Devonian, Carboniferous, and Permian. During the middle era, or Mesozoic, there were three, Triassic, Jurassic, and Cretaceous. During the latest era, at whose close we ourselves are living, there were two, the Tertiary and Quaternary. These eleven periods since the advent of life were each distinguished by its own types of organisms, now fossilized, and each was believed to be quite definitely and sharply outlined. If a European or an American geologist were to visit Asia or Africa, it was expected that he would find the evidence of the same times, and of periods that were contemporaneous and equivalent with those already known to him at home. This conception lasted until well beyond the student days of geologists now living. But as time went by the point of view changed and one finds today a much modified attitude regarding this, the very foundation of the stratigraphic or historical portion of the subject. The old view was as if we should endeavor to co-ordinate all human history with the chronology of the Romans; whereas in China or India events were progressing without regard to Rome and or equal importance to the human race broadly considered. Multitudes of men, so great as to dwarf the numbers of the Mediterranean peoples by comparison, lived, moved, and had their being in Asia, quite unaware that a Roman had ever existed. So in geology, we have learned that while there is a general similarity of conditions over the world at

*Abstract, by permission, from a lecture delivered on November 13, 1907, by the professor of geology in Columbia University and published in the *School of Mines Quarterly* of January, 1908. Copyright Columbia University Press.

any one time, yet the conditions have not been uniform and that each locality must be viewed by itself. We have all come to realize that so far from establishing contemporaneous life, identical fossils in separated localities indicate a wide difference of dates. The studies of the paleontologist lead to conclusions similar to those of the zoologist, that groups of animals or plants migrate from centres, spread abroad along belts of favorable conditions, sometimes driving out earlier inhabitants, and certainly for a time mingling with them until in the end they established colonies remote from their starting point. These migrations require long stretches of time, and radically change our old conceptions. The same species on opposite sides of the world means, therefore, not the same time for both, but a long interval between. Indeed, while in one locality organisms of a later type may be flourishing, elsewhere animals of earlier and more primitive characteristics may still be in the full tide of their activities. Just as today in Australia we have a fauna which is a survival of genera long since extinct in other parts of the world, so in the past, whose records have come down to us, the same contrasts have prevailed. What is Quaternary or Recent in one place, may be Mesozoic simultaneously in another.

You will see at once how much more complex is the history of the globe, when interpreted in the light of the higher criticism which places the observer face to face with actual conditions, and how changed is necessarily the attitude of the geologist of today regarding these fundamentals when compared with that of his predecessors, and even with the views of his own earlier instructors. Turning to the future outlook, shall we anticipate the passing away of our established chronology? Shall we cease to speak of a Cambrian or a Carboniferous period as world-wide in its application and of fairly sharp definition? Shall we reduce ourselves to local sections each with names of geographical derivation and suited to a limited area, only running comparisons in a very general way? Some geologists have been impressed with this as the inevitable development. But others, while appreciating the limitations placed upon the old divisions and the mistaken views which followed their precise and universal application, yet see in them when discreetly and wisely employed, the statement of a great truth. Realizing the indefiniteness of the boundaries, they yet cling to the underlying and vastly useful general application and will long continue to use the time-honored terms. The two periods of the Archean era, the six of the Paleozoic, the three of the Mesozoic, and the two of the Cenozoic in not too sharp application are certain to be retained for many years to come, but the tests of their identity must be more complex and must be applied with a more comprehensive grasp of the situation.

As regards the appearance and development of life upon the earth the two most interesting questions for the world at large, relate to its beginning and to its later stages. They concern on the one side the forms which the oldest living creatures assumed, and on the other the advent of man himself. We cannot contemplate these questions without having our thinking influenced by the evolutionary doctrines. The first remains of life in the Cambrian strata consist of hard parts such as the shells of mollusks, which were calcareous when the animals were alive and which retain in large degree their original composition. Only resistant and enduring materials of this sort could survive through long periods of time. They indicate highly organized creatures, and are generally believed to have been preceded by ancestors of simpler types. For the remains of these ancestors, geologists have searched the older strata with the care and persistence which the importance of the question demands, since to push the evidence of life back of the Cambrian is to win one of the great prizes in geological science. But hitherto the results have been most meagre. They are limited to a few indefinite tracks or questionable impressions.

Opinion, therefore, has swung around to the conclusion that the earliest organisms were marine and that they were soft-bodied animals which on death left no trace in the sediments of their time. Along two lines of attack there is a most interesting corroboration. R. A. Daly, now in Boston, has been led by detailed studies in the extended series of Cambrian and Pre-Cambrian strata along the national boundary between British Columbia and the northwestern States, to the conclusion that the Pre-Cambrian sea was devoid of dissolved salts of lime, and that, by reactions incident to the decay of soft-bodied animals upon its bottom it was robbed of such little lime as it might otherwise have had. For a number of reasons too complicated and detailed to present here, there is good ground for believing that not until the opening of the Cambrian was sufficient lime available in the sea water to encourage the growth of those hard calcareous parts which yield the fossil remains.

Along another line of attack very interesting conclusions have been reached. A. C. Lane, the State Geologist of Michigan, has sought to solve the problem of the composition of the oceanic waters at various periods in the earth's history by a study of the deep artesian supplies which we gain from boreholes reaching older and older beds. From the samples of course must be eliminated contributions from higher horizons of matter not contained in the waters at the time of entombment. When all precautions are exercised we discover in the end that the oldest waters are relatively dilute when compared with the sea of today and that they have but seven parts in the thousand as contrasted with the modern thirty-five. Common salt was the most abundant then as now. A very interesting connection of these researches with the problems of early life is furnished by a line of investigation pursued by R. Quinton, of the College of France. In all but the simplest organisms there is a so-called vital fluid which is the basis of the circulatory system. If, for instance, we eliminate from the blood of vertebrates or other animals the red and white corpuscles and the products of organic waste and then analyze the remaining fluid we find a weak solution of common salt in water

varying slightly in the different types, but something like seven or eight parts in a thousand. This is believed by Mr. Quinton to represent the ancient sea water in which the ancestors of all modern organisms lived and from which some forms emerged in the past. Employed as a vital medium of circulation it became enclosed in those organisms which developed the interior sack having only communication with the outer world by osmosis, and its composition having been preserved, it recalls the early ocean, in which their ancestors originally lived. It is at least a striking coincidence that the composition of the vital medium is just about the composition of the sea as indicated by Dr. Lane for the early Cambrian or Pre-Cambrian times. If, as seems not unreasonable nor improbable, this composition, attained in the absence of salts of lime, was particularly favorable to organic life, then the Pre-Cambrian sea may have swarmed with soft-bodied organisms. And if, with increasing land areas, more lime poured in from their drainage and the composition of the sea changed, then some animals took to the land, others developed hard parts and left the fossil remains. But in the vital medium of their circulating systems they maintained a solution corresponding to the composition of the sea water which had proved most favorable to their nourishment in the previous marine period of existence. These suggestions are at least ingenious and turn our thoughts into new and promising channels which are worthy of careful exploration.

Toward the opposite extreme in the geological record of life upon the earth lies the problem of man's appearance, a question which links geology with anthropology. It is only upon its geological aspects that I purpose to touch, and solely of two of its phases do I desire to speak. That the general attitude of educated people toward this problem has become more tolerant in fifty years is now well realized. One may refer to the evolutionary descent and antiquity of man without, as happened in the case of the famous Calaveras skull, thereby cutting short the life of a State geological survey. We were formerly too much inclined to mix up souls and bones.

It is now 48 years since Darwin's 'Origin of Species' was first published and 36 since his 'Descent of Man' appeared. The last-named work squarely propounded and defended an evolutionary development from ancestors among the primates. In anatomical relations to living types there was a profound gap between man and the highest apes, most marked to the general comprehension in the sizes and shapes of the skull and brain cavity. Interest became focused upon the hoped-for discovery in some hitherto unexplored part of the globe either of the still surviving 'missing link' or else of fossil remains intermediate in type.

In the three or four decades which have elapsed since Darwin's books started investigations, no discovery of living man-like creatures of additional significance in these respects has been made; nor do we believe that such exist in the deep recesses of any unknown jungle. But in one notable instance the search for fossil remains has been more successful. On the banks of the Bengawan river, in Java, there are Pliocene or late Tertiary beds that for several years prior to 1895 were explored by Eugene Dubois, a military surgeon attached to one of the Dutch regiments. Dr. Dubois unearthed a partial skeleton of a man-like creature whose leg-bones showed that he walked erect and whose skull was intermediate between those of the highest apes and man. The volume of the brain cavity is two-thirds that of the average man, and the outline of the skull is not very different from some of the lowest types already known among prehistoric remains. Suppose that we assume a critical attitude and insist that if man existed in these times, we question whether this specimen is a fair representative. We may consider it abnormal and below the average of his day. Nevertheless the presumption is strong that it is normal, since abnormal ones are the rare exceptions. Granted this, many have believed that the remains point to a separate line of descent from that of the apes, and that if we consider the fossil as indicating the ancestors of men, then the latter have come down a branch or phylum distinct from the line of the primates.

As to the presence of man in relation to the great ice sheet of the Glacial epoch, it seems now fairly well established that in Europe he was existant in the later stages. In America the evidence is less strong and abundant, and while such as we have has been subjected to much destructive, and, it would seem at times, strongly prejudiced criticism, yet there is some rather good ground for inferring that on this side of the Atlantic as well as in Europe, primitive man was living in its closing stages. The results, however, of patient and comprehensive investigation have operated to show the great complexity of the Ice Age. Its boulders and sands are of widely different and contrasted dates. We may not rashly assume its contemporary character in separated parts of the country. Man's presence in its closing stages but reveals the long duration which went before while yet portions of North America were in the grip of extreme cold. The best we have done is to show that presumably in the later stages man was existant.

The labors of the Swiss, French, and German geologists in the wonderfully crumpled and faulted strata of the Alps and the no less fruitful observations of the Americans in the Appalachians have established the several kinds of folds and faults, the great structural features of the sedimentary rocks.

In the regions of extinct and dissected volcanoes, moreover, and in the localities of deep-seated eruptive rocks, the records of many patient workers have taught us of the forms and features of the igneous group. The excavations of the miner have revealed both sedimentary and eruptive rocks with an accuracy and minuteness of detail not afforded in any other way. To the general conceptions now firmly established in this branch of the subject we are not likely to add much that is new or important in kind, but within the last few years we have seen them greatly change in degree. We have long known, for

example, that excessive contraction of the crust first doubles strata together, then pushes the compressed fold over on its side, and finally forces the crumpled mass along above the beds lying beyond the folded area, leaving older ones stranded upon later. In the southern Appalachians, the overthrusts have carried the beds as much as five miles from their starting points and subsequent erosion has destroyed any visible connection. With some such distances as these we have long been familiar.

But recently the European geologists have worked out cases in the Alps where the shove has displaced the beds as much as fifty miles from their old positions. It has therefore been necessary to enlarge our conceptions by a factor of five or ten. The discoveries are new and the distances involved are so great that some time will be required in which to readjust our old-time sense of proportions, but we all realize that in these greatly compressed areas the movement was propagated along a fault plane or a series of fault planes of flat inclination which began well down in the earth's crust and which probably once continued beyond their present lines of emergence. When, however, we seek some satisfactory cause or explanation of these phenomena, both smaller and greater, we are as yet not entirely successful. The contradictory riddle of every great mountain system still confronts us. For example, we know that from New York to Alabama that portion of the Appalachians which we ordinarily call the Alleghenies consists of sands, muds, shell-beds, and coral reefs, the latter two often comminuted to slimes. In the case of the sands and the muds, the materials must have been worn by the waves from older lands, presumably to the eastward. They must have been laid down in shallow waters, layer on layer, until they became thirty or forty thousand feet thick. It is a difficult question to decide what caused the great trough to sink so gently that sedimentation nearly kept pace with subsidence throughout the long Paleozoic era. Why does the earth wrinkle downward in some localities for long periods of time and then, more remarkable still, why does it suddenly change its course and wrinkle upward, bringing the one time bottom of the sea into wave-like ridges which follow one another like so many great billows, petrified in mid-course as they roll in upon a shore. These evidences of past disturbances even more significantly than the earthquake shock of today lead on irresistibly downward to the interior of the earth and to the problem of its physical condition, one of the most interesting with which we have to deal and one regarding which opinions have passed through many changes in late years.

When the geologists who are today in middle life were students, the earth was widely believed to consist of a crust, perhaps 50 miles thick, hardened upon cooling, and surrounding a highly heated molten core which fed the volcanoes, which admitted of adjustments, and which was the still hot representative of the old incandescent nebula from which all had been derived according to the nebular hypothesis. In my own student days, the attacks of the mathematicians upon this view were beginning to be felt by the geologists. The important consideration of the rigidity of the earth, resisting deformation as it does while rapidly rotating, the lack of internal tides and similar arguments were leading to the view that a vast liquid interior was an impossibility. The effects of the pressure produced by the weight of the outer portion which rests upon the inner core and its effect in raising the fusing point to temperatures impossible of attainment were also gradually realized. A compromise view became widely prevalent. It involved the outer crust which we knew from experience was solid, evidently to a depth measured in miles; an inner layer of fused material, intervening before the pressure became too great; and then a solid core. From the fused layer came the lava of the volcanoes. Its adjustments made the ups and downs of the mountainous regions possible and its shrinkage and that of its crust from loss of heat, furnished the contractile strains which primarily caused the folds and faults. Joseph Le Conte, for so many years the greatly beloved instructor in the University of California, was a stout defender of this conception.

But the mathematicians returned to the attack and on the principles of sound mechanics maintained with force that nothing but an essentially solid and resistant globe would survive the evident strains to which it is subject. We must believe, they have told us, that from surface to centre the earth behaves with no less rigidity than would a sphere of steel. Gradually geologists have come around to this view, but have modified it by a further conception which must be coupled with it in order to account in any satisfactory way for the evident phenomena of the mountains on the one side and the volcanoes on the other. The earth is solid, we admit; it is highly heated, certainly to very great depths; but all matter, however brittle under the conditions prevailing at the surface, becomes appreciably plastic when confined on all sides and subjected to pressures beyond its crushing resistance. Under these circumstances, rocks will flow as viscous media while losing in no respect their cohesion. In the deep-seated metamorphic rocks we see these evidences of flow, and that the flowage is possible, we positively know from the experiments of Professor Adams.

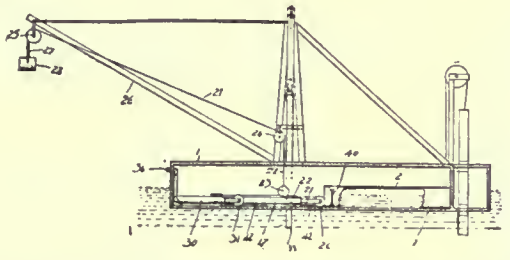
We may, therefore, regard the interior as essentially solid, yet moving with a slow viscous flow in any direction of less pressure. It undoubtedly is highly heated, yet it is not a molten liquid as formerly regarded. If, however, during a viscous flow toward a point of less strain the interior rises toward the surface, it is subject to less and less pressure, and inevitably in time reaches conditions under which the rocks must fuse. The vapors and gases held in all deep-seated strata are freed, and the once solid rock becomes the molten lava with which we are familiar in volcanic eruptions. Volcanoes mark, therefore, at least in their inception, restricted areas in the upper world of such low or eased pressure that toward them the deep-seated rocks pass until they can flash into a molten and even explosive condition.

(To be Continued.)

MINING AND METALLURGICAL PATENTS.

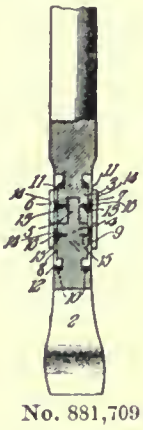
Specially Reported for the MINING AND SCIENTIFIC PRESS.

HOISTING APPARATUS FOR DREDGERS AND THE LIKE.—No. 881,838. Robert M. Wilson, San Francisco, California.

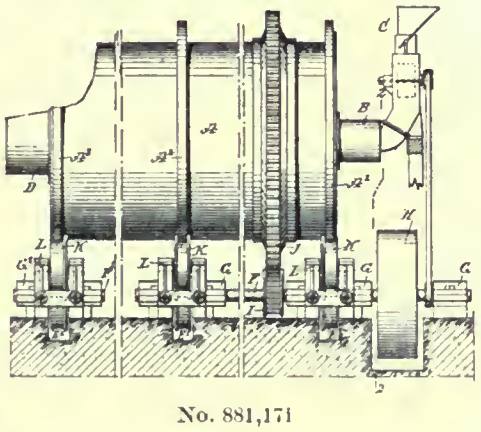


In an apparatus of the character described, the combination with mechanism for applying power, of a cylinder, a plunger therein, an operative connection therefrom to said mechanism, a receiver for pressure fluid, a connection therefrom to said cylinder, and means for forcing compressed air and a liquid into said receiver, substantially as described.

DRILL-CHUCK.—No. 881,709. Daniel J. O'Leary, Green Bay, Wisconsin.



No. 881,709



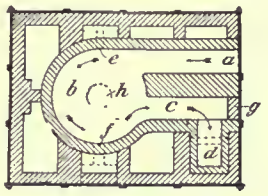
No. 881,171

A drill point connection for deep well drills comprising a drill rod having at its end an axial screw socket and diametrically opposed longitudinal grooves on each side thereof terminating in end recesses entering the body of the drill rod, a drill point having a screw stem adapted to the screw socket and the drill rod, and also having diametrically opposed longitudinal grooves terminating at one end in recesses, the grooves in the drill rod and drill point being located to match when the drill point is screwed into the drill rod, links having heads at each end projecting at right angles to the length of the links, and adapted to be seated in the grooves and recesses on opposite sides of the joint between the drill rod and point, and means for holding the links in their seats.

ROTATING DRUM.—No. 881,171. Richard F. Abbe, Hoboken, New Jersey.

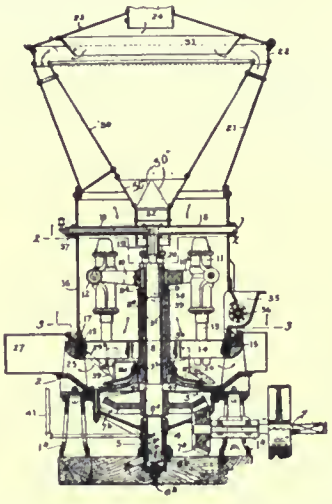
A device of the character described comprising a drum having external annular bearings, one located approximately at the middle of the drum and the others located at or near the ends of the drum, a gear wheel fixed on the said drum, adjacent to one of the end bearings, a driven shaft extending beneath one end of the drum and located in a vertical plane passing through the axis of the drum, supporting wheels mounted on said shaft and in frictional engagement respectively with the annular bearing at one end of the drum and the middle bearing, a pinion secured to said shaft between the said supporting wheels and in mesh with the gear wheel on the drum, a second shaft extending beneath the other end of said drum and in axial alignment with the said driven shaft, a supporting wheel loosely mounted on said second shaft and in engagement with the bearing at said end of the drum, guide rollers peripherally engaging the said bearings of the drum and located on opposite sides of the said supporting wheels.

REVERBERATORY FURNACE.—No. 881,110. Frank Cotton, Hornsby, New South Wales, Australia.



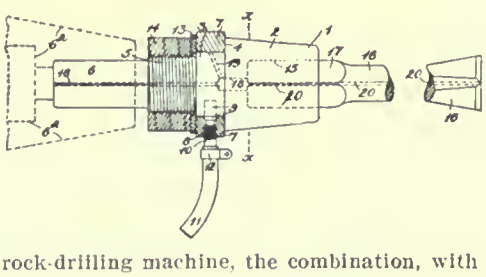
A reverbatory furnace comprising inner and outer walls separated by a filling of sand, a circular furnace chamber having a concaved floor and domed roof, an intake conduit arranged tangentially to the circumference of said chamber, the length of said intake conduit being approximately equal to the diameter of the furnace, and an outlet conduit parallel to and in the same horizontal plane as said intake conduit but located non-tangentially with respect to the circumference of the furnace chamber.

METHOD OF WORKING GAS FURNACES.—No. 881,724. Paul Schmidt and Adolphe Desgraz, Hanover, Germany.



A method of maintaining a body of molten material within a furnace at a uniform temperature throughout which consists in subjecting the material to the action of a heating flame which spreads in an even manner entirely over the material by introducing into the furnace a mixture of combustible gas and air, the latter being in excess of the former, and further introducing into the furnace a mixture of combustible gas and air, the former being in excess of the latter, said excess of air of the first mixture causing the excess of gas of the second mixture to be burned in the form of a long flame which evenly spreads entirely over the material.

WATER-SUPPLYING ATTACHMENT FOR ROCK-DRILLS.—No. 881,579. Henry Heilman and Lewis C. Bayles, Johannesburg, Transvaal.



In a rock-drilling machine, the combination, with a drill, of a detachable make-up piece positioned at the front end of the drill and supported and rotated thereby and constructed at the forward end with a hole of non-circular transverse section, a bit constructed with a portion of corresponding non-circular transverse section loosely positioned in the hole in the make-up piece and supported and rotated thereby and constructed with a longitudinal hole communicating with the hole in the make-up piece and leading to the cutting end, a swivel mounted on the make-up piece, and means for conducting water to the swivel.

THE GREAT ZUNI DAM.

The Zuni dam was completed during the month of January, 1908. The dam proper is 90 ft. high, 450 ft. long, 410 ft. wide at base, and 30 ft. wide at top. It is a combination rock and earth fill—the rock laid up dry 140 ft. at base, 10 ft. at top. The dirt was put in by the hydraulic process, and is 270 ft. at base, and 20 ft. at top. The slope was covered with a foot of gravel, on which was placed 18 inches of rip-rap set on edge, and on top of this was placed another foot of gravel. The water is drawn through a concrete tunnel 450 ft. long, which connects with a concrete gate tower 60 ft. high inside the reservoir. The reservoir when full will cover 640 acres, at an average depth of 35 ft. A spillway 100 ft. wide provides for the discharge of flood waters. The labor was done by Indians, superintended by a few white men. The dam was built by the Indian Bureau, for the benefit of the Indians of the Pueblo of Zuni. The water is to be used for irrigation purposes. The drilling of the rock for blasting was done by the use of Wood drills, supplied by the Wood Drill Works, of Patterson, New Jersey. These machines were operated by Navajo Indians, as shown in the accompanying photograph.

EGYPTIAN EXCAVATION.

From the Arthur Koppel Co. we have received an interesting note concerning the part their equipment played in the important explorations made in Egypt under the auspices of the Stanford Archæological Expedition. A view of part of the excavation work near the base of one of the Pyramids is shown; this gives an idea of the nature of the operations and the character of the labor employed.

By the use of Koppel portable track circular lines of rail were laid where excavations were being made. By this arrangement it was possible to tram the empty cars to the different loading stations and convey the loaded material to the dump without blocking the different lines. As the excavations were enlarged it was also easy to shift and adjust the track without serious interruption to the car service. The standard Koppel V double side dump-cars of 2-ton capacity were used for the transportation of the material. It was necessary that they be light-running when fully loaded, as the tramming was done by the natives. With this equipment rapid and efficient work was accomplished, and the adaptability of this equipment for widely different requirements was demonstrated.

COMMERCIAL PARAGRAPHS.

Atkins, Kroll & Co. of this city carry a stock of fine fireclay, silica, and magnesite firebricks, and are able to supply shapes, boiler tile, reverberatory furnace floor tile and assay furnace tile.

The Hendryx Electric Cyanide Co., Denver, Colo., has recently donated to the State School of Mines, Golden, Colo., a combination cyanide agitator and agitator for copper ores, to be used at the school for testing and experimental work for the students.

The Koch Mfg. Co. has just completed and shipped two 18-in. steel lined dredging pumps, each of which weighs over 30,000 lb. These special pumps are to be driven by two 500-hp. motors, and were designed to be used in deepening ship channels at Tacoma, Washington.

The Denver Fire Clay Co., of Denver, has recently started the glass-blowing department and is now prepared to do all kinds of special repair work, and will also make thermometers, hydrometers, etc., and do scientific and technical glass-work. This department has been closed down for some time past, and they have recently secured an expert from Scotland who has had wide experience in this specialty.

H. C. Holthoff has accepted an appointment from the Allis-Chalmers company as manager of the new office which is being established in Mexico City. H. C. Holthoff's office will be fully equipped to answer inquiries from prospective buyers of all classes and to furnish literature and quote prices on all lines of Allis-Chalmers machinery, including not only mining, crushing, and cement making machinery, but also steam-engines, steam-turbines, gas-engines, hydraulic turbines, electrical machinery, saw-mill and flour-mill equipments, pumps and pumping machinery, transmitting machinery.

CATALOGUES RECEIVED.

The Link-Belt Co. has issued its chain catalague for 1908.

The Keystone Driller Co. has issued Catalogue No. 6, describing Downie Deep Well Pumps.

The Schutte & Koerting Co. has issued catalogue No. 2, Section R, describing Koerting water-jet eductors for mines and tunnels.

The Clark Dredge Mfg. Co., of Chicago, has published an attractive folder describing in detail its hydraulic gold dredge. The pamphlet is well printed and illustrated.

PUBLICATIONS RECEIVED.

United States Treasury Department. Document No. 2493: 'Annual Report of the Director of the Mint for the Fiscal Year Ended June 30, 1907.'

The Department of Mines of Tasmania has issued the following bulletins: 'No. 1. The Mangana Goldfield.' 'No. 2. The Mathinna Goldfield,' and a report on 'The Progress of the Mineral Industry of Tasmania,' by W. H. Twelvetrees, Government Geologist.

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Editorial.

A MEETING for organization of the Mining and Metallurgical Association of America will be held at the Engineers' Club, on West Fortieth Street, New York City, on Monday, April 20. The number of charter members enrolled is 106.

LONDON has a Lawson of its own and of similar character to the Boston mountebank, whose alarums and excursions into foul finance have prostituted the pages of the daily press. The spoofer in England is named Victor and in this way he differs from Thomas.

IT IS interesting at this time to note that the silicious ore of the Centennial-Eureka mine, at Tintic, Utah, is sent to the Mammoth smelter, in Shasta county, California. We look forward to a time when the smelting industry of California will be so developed as to stimulate the mining industry of the entire region west of the Rocky Mountains.

POSTAL RATES have a tendency to improve by diminution, and every increase of facility in this regard is of direct benefit to humanity at large. To business and to industry the postal lines of communication are as nerves to stimulate profitable energy. Many of our readers may not be aware that since October 1, 1907, the rate on letters to foreign countries has been 5 cents for the first ounce, or fraction thereof, and 3 cents for each additional ounce or fraction of an ounce.

THE DISMISSAL of the Federal suit against Mr. John A. Porter, of Denver, in connection with the acquisition of coal lands near Durango is of more than personal interest, for it is known that Mr. Porter was anxious not to evade trial but to undergo examination with a view to clearing his name of an unwarranted charge. In these days of careless aspersion of character and widespread corruption, it is a pleasure to record the fact that a man of honorable reputation was neither guilty of a charge of wrong nor unwilling to face the accusation.

MATTERS pertaining to the proposed Mining Bureau at Washington are progressing. The Senate has made an appropriation, to the Secretary of the Interior, of $190,000 for investigation of mine accidents and explosions. This appropriation is available either to the Geological Survey or the Bureau of Mining Technology, as circumstances may warrant. The money is subject to application at the discretion of the Secretary of the Interior. Senate bill No. 4783, for a Bureau of Mining Technology,

has been under discussion by a sub-committee of the House Committee on Mines and Mining. Mr. W. P. Englebright, of California, who is chairman of this sub-committee, has done splendid work, and the hearings have elicited valuable evidence. The strongest advocates have been the spokesmen for the coal operators and the miners' unions. This measure has been almost the only thing they have agreed upon this year, and both parties have sent strong delegations to Washington to work for the bill on the ground that what was most needed at present was scientific investigation rather than compilations of so-called "practical information" by legislative commissions. If the House takes the responsibility of passing this bill, the Senate is likely to agree. All interested parties, in the Survey and out of it, are working in apparent harmony, and the question of statistics has been shelved for the present. Whatever the result, the public discussion of the problems created by the tremendous growth of the mining industry is sure to be beneficial, by awakening the interest of the public and stimulating the intelligence of the legislators.

ON the editorial page of *The Call*, a San Francisco newspaper, we read that the output of the gold mines of the Mysore, in India, is increasing, although our readers are well aware that the production from the Kolar goldfield—the only one in Mysore—has been steadily declining since 1905. But that is a detail. The important point is—according to *The Call*, which got its information from a consular report—that "the geological structure of Mysore state is mainly hypogene schists penetrated and broken up by plutonic and trappean rocks in every form of intrusion and overlaid with occasional patches of laterite and the kankar calcareous deposit." All of which, on the face of it, seems highly probable; in fact, it could scarcely be otherwise. What a geological saturnalia! It is almost as bad as the recent description of a vein at Rawhide as "a core or deposit well defined by granite contacts with a porphyritic or sedimentary filling. This is not an igneous upheaval but a pure and simple sedimentary hot water or geyser deposit, divided by 15 porphyritic feet wide." You pay your money and take your true granite dikes, with a filling of from 250 to 300 choice.

THE KANSANSHI copper deposits, as described in an interesting article by Mr. J. R. Farrell, published elsewhere in this issue, evidently present a problem in ore-genesis which remains for later investigators to solve, but it would seem that the existence of immense masses of ore is assured. A point in this connection, with which many experienced engineers will sympathize, is the defense that Mr. Farrell offers for the manner in which his original conclusions concerning the probable importance of these deposits were reached under conditions which prohibited careful sampling and demonstration of the size of orebodies available. Subsequent developments have vindicated his judgment, and this suggests how valuable may be the opinion of an engineer of wide experience even when based upon a hasty reconnaissance. But it is dangerous, nevertheless, and such practice is not to be commended for frequent imitation. The line between realization of the significance of facts, which may at times be pregnant with meaning to the right man, and the intuitions of the wrong man, is one that must be drawn by the engineer himself. He may err in drawing it, and the safer way is to leave such methods as a resort in extreme cases only, like the one presented in this instance, where it was a question between that or nothing. Apart from this the article is valuable as a reliable statement of the great possibilities of Central Africa as a future producer of copper.

Timber and Mine Costs.

THE SERIOUS EFFECT which the drain upon our national forests will exert upon costs of mine operation in the near future appears from the fact that recent estimates by the United States Geological Survey, in co-operation with the Department of Agriculture, indicate the existence within the United States of timber sufficient for only 33 years, granting as a maximum that the standing stumpage will reach fourteen hundred billion feet, and that the annual growth will amount to forty billion feet. This estimate is based upon the continuance of consumption at the present level of one hundred billion feet per year. The expansion of industry and the temptation to large lumber production under the stimulus of increasing prices, will inevitably swell the consumption, in spite of the substitution of other material for timber. The quantity of timber consumed in the mines of the country has not been accurately ascertained, but round timber to the extent of 165,000,000 cubic feet, equivalent to approximately two billion feet board measure, has been traced. This represents only a fraction of the actual consumption in the mines. In the East it is probable that a large increase in the present high prices will compel resort to substitutes more extensively than in the West, where the quotations on timber appear small by the side of Atlantic sea-board rates, so that Western prices may double before it will become more economical to apply steel and other substitutes on a large scale. The chief reliance of the Rocky Mountain region, and of the West Coast, is upon Douglas fir, popularly known as Oregon pine. The total stumpage of this timber available, according to the highest estimate, is three hundred and fifty billion feet, which would be exhausted at the present rate of cutting in 70 years. It is assumed that the output of this lumber will rapidly double and will reduce the time-limit for exhaustion to about thirty years. A corresponding advance in prices is inevitable.

As an evidence of what this would mean to the mines in the West, the operating expenses at several representative properties show that the expenditure for timber ranges from 15 per cent of total costs in the desert region, to 5 per cent in mines favorably situated near to the great forests of the Northwest. In one large Colorado property the item for timber

is 28 cents out of a total cost of $2.07 per ton of ore extracted, or 13½ per cent. With prices for timber doubled this single item would then rise to 23.8 per cent of the mine-costs per ton of ore. At the Yellow Aster mine in the arid region of southern California a report was given out several years ago, when timber was selling at prices far below those of the present day, indicated an outlay on this account of 18 cents in a total cost per ton of ore of $1.16, or 15.5 per cent. A doubling of timber prices would in this instance bring up the percentage of costs per ton for this item to 27 per cent. At the Bunker Hill & Sullivan, where costs have been hammered down under efficient management to $1.46 per ton, the timber item is 15.7 cents, or 10.75 per cent. A like change in the timber market, other costs remaining fixed, would elevate this to 19 per cent. It is evident that not only must increasing attention be directed to the introduction of mining methods admitting to a greater extent of the omission of timber-supports, but in shafts and gangways, and other permanent openings, the use of creosoted timber should be encouraged. This would effect economies by prolonging the life of the timber at least four times beyond that of untreated material. Incidentally, such are the intricate correlations of industry, an important demand for creosoted timber, which will call into existence treating plants at the great ports of the Pacific Coast within the next few years, will stimulate by-product coking in the Western coalfields by offering an additional outlet for the tar derived as a by-product from retort-coking, and this in turn will promote the utilization of the surplus sulphuric acid which the smelting companies are compelled to produce in the abatement of the smoke nuisance, by its conversion into ammonium sulphate with the ammoniacal liquors constituting an additional important by-product from coking.

The Falls of Niagara.

THIS is the title of a book published recently by the Geological Survey of Canada and reviewed, most adversely, by us in our issue of February 22. It is a report by Dr. Joseph William Winthrop Spencer. Since the publication of our criticism, the matter has been brought before the Canadian House of Commons and the Minister of Mines has been asked sundry pertinent questions. Furthermore, we learn, from several correspondents, that Mr. Frank J. Nicolas, the editor of the Survey publications, has been dismissed, and that he is charged with having written the offending criticism. Therefore, an explanation is necessary.

The report came to us in the ordinary course of exchange with the Geological Survey of Canada. Our readers need hardly be told that no destructive criticism of any book would be published in our columns if contributed from the outside. This was done recently by the London *Mining Journal*, which printed a mean attack on the excellent treatise on 'Dredging for Gold in California' by our friend Mr. D'Arcy Weatherbe, the attack emanating from the author of another book on the same subject. As regards the review of Dr. Spencer's report, that was written, wholly and entirely, by the editor of the MINING AND SCIENTIFIC PRESS, who abominates pseudo-scientific balderdash whether it appears on the glossy pages of a beautifully printed volume or on the wrapping paper of an irresponsible daily periodical. In reply to questions concerning the publication of Dr. Spencer's report, it has been stated by the Minister of Mines that it cost $5148.69, which is about three times the usual cost of publishing a scientific treatise of a kindred character. However, we are not surprised at the cost, for the mechanical part of the publication must have been as expensive as it was excellent. The report is well printed and beautifully illustrated, far beyond the merits of the matter it contains. From the same authority we learn that Dr. Robert Bell made the original agreement with Dr. Spencer; that when Dr. Low became director of the Survey he questioned the advisability of publishing the report; that Dr. Low found it impracticable to evade publication; that the editor of the Survey found it difficult to revise; that finally "the author undertook to have it put into good English and properly published, agreeing to absolve the Survey from any criticism as to form and matter." The report was in print before Mr. R. W. Brock became acting director. All of which indicates the presence of those political undercurrents that impede honest men in the performance of their duty. We are in receipt of a letter from Dr. Spencer addressed to the "manager" of this journal, protesting against the action of the "editor." Fortunately, the editor of the MINING AND SCIENTIFIC PRESS is not subject to dismissal for doing *his* duty, as was the fate of Mr. Nicolas. Unfortunately, the reports of the House of Commons debates are themselves badly in need of proof-reading, for the pages sent to us exhibit a large number of typographical errors calculated to make the quotation of our criticism appear as cryptic as the report criticized. But that is no fault of ours. Dr. Spencer objects to the excerpt of seven paragraphs "which were grammatically correct and comprehensive, and were selections disconnected from their context." This is an objection that we had weighed; such excerpts are apt to do injustice to an author and that is why we made them rather long. If any reader doubts the fairness of our sampling, let him get the report itself, by writing to the Director of the Geological Survey of Canada. We are willing to abide by the judgment of any qualified man. Then let him enquire at Washington and at Albany, whether the report was not offered to the Surveys of the United States and of the State of New York before it was underwritten in Canada. The Minister of Mines himself admits that Dr. Low advised against the publication of the report. We can only add that no such perplexing and confounding semi-scientific material should ever have been accepted, no matter what political pressure was brought to bear, and we hope that the people of Canada will see to it that Mr. Nicolas receives just treatment at the hand of the Minister of Mines, a member of a government already notorious for corruption.

Personal.

ALFRED JAMES has gone to South Africa.

VICTOR G. HILLS is at Telluride, Colorado.

WALTER C. BRACE, of Denver, is in Nevada.

HERBERT HAAS is in Mexico for a few weeks.

EARL R. PEMBROKE has been in Montana recently.

OSWALD STEIN is now resident at Goldfield, Nevada.

JEROME B. LANDFIELD is at Cannes, in southern France.

FRED. S. PHEBY is in San Francisco from Ely, Nevada.

THOS. B. STEARNS, of Denver, was at Goldfield this week.

A. H. ELFTMAN, of Tonopah, spent a few days at Goldfield.

H. A. SHIPMAN, of Denver, is at Rico, Colorado, for a week.

ARTHUR L. PEARSE is expected at Seattle, on his way to Alaska.

C. G. PATTERSON has returned to San Francisco from Mexico.

W. J. LORING left London on April 11, on his way to San Francisco.

FRANK PETERSON, of New York, is operating at Manhattan, Nevada.

M. B. ZERENER was at Goldfield recently, and is now at Ely, Nevada.

POPE YEATMAN is expected at Ely. On April 25 he will go to New York.

H. V. WINCHELL has recovered from his accident and is now at Butte.

F. L. MORRIS, on his return from Seattle, went to Silver Peak, Nevada.

GEORGE W. PEIRCE is with the Nevada Goldfield Reduction Co., at Goldfield.

FRANCIS A. THOMPSON has returned to Pullman, Wash., from the Coeur d'Alene.

CHAS. W. MILLER, who is mining in Tuolumne county, California, is at Denver.

A. B. ROMBAUER is manager of the Ingram mine at Salina, in Boulder county, Colorado.

RALPH NICHOLS is on his way from Durango, Mexico, to his home at Aurora, Illinois.

LLEWELLYN HUMPHREYS has arrived in Goldfield on a reconnaisance from Ely, Nevada.

JAMES LINDSEY, of New York, is in San Francisco, having recently visited Rawhide, Nevada.

CHARLES HOYLE succeeds W. E. HINDRY as manager of the Esperanza mine, at El Oro, Mexico.

L. E. BEDFORD is manager of the Republic mine, at Graniteville, in Nevada county, California.

ARNOLD BECKER has been critically ill with pneumonia at Goldfield, but he is recovering satisfactorily.

C. W. WININGER has become assistant superintendent of the Amparo mine, Etzatlan, in Jalisco, Mexico.

E. D. LACHMAN has severed his connection with Charles Butters & Co., and has gone to his home in Reno.

ERNEST R. BUCKLEY has resigned as State Geologist of Missouri to accept a position with the Federal Lead Company.

J. WALTER GEDDES is manager of the Daisy mine at Goldfield. He has just returned thither from Oroville, California.

OSCAR LACHMUND has left the United States Smelting Co., at Salt Lake, to become manager for the Mine La Motte company, in Missouri.

J. PARKE CHANNING sailed for Europe on April 14, accompanied by ADOLPH LEWISOHN. They will visit Paris, Berlin, Hamburg, and London.

FRED. L. JOHNSTONE, of Santa Barbara, passed through San Francisco last week, bound for Reno, Nevada. He will later make professional visits to several Nevada camps.

Latest Market Reports.

LOCAL METAL PRICES—Apr. 16.

Antimony	12@16c	Quicksilver (flask)	$45@45.50
Casting Copper	14¼@15¼c	Spelter	6½@ 7¼c
Pig Lead	4.35@ 5.30c	Tin	32½@34c

ANGLO-AMERICAN SHARES.

Cabled from London.

	Apr. 9. £. s. d.	Apr. 16. £. s. d.
Camp Bird	0 13 0	0 14 0
El Oro	1 2 6	1 3 0
Esperanza	1 6 3	1 8 0
Dolores	1 5 0	1 5 0
Oroville Dredging	0 12 0	0 12 0
Stratton's Independence	0 3 0	0 3 0
Tomboy	1 10 0	1 11 3

(By courtesy of W. P. Bonbright & Co., 24 Broad St., New York.)

MINING STOCK QUOTATIONS—NEW YORK.

	Closing prices. Apr. 9.	Apr. 16.
Bingham Central	⅝	½
Boston Copper	11⅛	11⅝
Cumberland Ely	8¼	7⅞
El Rayo	1¾	1¾
Giroux Con.	3¾	3½
Guanajuato Con	2	.....
Nevada Con	11¼	11¼
Nipissing	6½	6⅝
Tennessee Copper	42	40½
United Copper	7	6½
Utah Copper	30¼	30

(By courtesy of Hayden, Stone & Co., 25 Broad St., New York.)

SOUTHERN NEVADA STOCKS.

San Francisco, Apr. 16.

Atlanta	$ 26	Manhattan Con	15
Belmont	1.30	Midway	66
Columbia Mtn	22	Mizpah Extension	.....
Combination Fraction	72	Mohawk	.....
Daisy	1.30	Montana Tonopah	1.90
Fairview Eagle	40	Nevada Hills	2.70
Florence	4.10	Rawhide Queen	1.85
Gold Bar (Bullfrog)	15	Red Top	.....
Goldfield Con	5.65	Sandstorm	37
Gold Kewanas	37	Silver Pick	20
Great Bend	78	St. Ives	34
Jim Butler	33	Tonopah Extension	1.37½
Jumbo	.....	Tonopah of Nevada	9.00
Jumbo Extension	34	Tramp Con	23
Laguna	1.05	West End	37

(By courtesy of W. C. Ralston, 353 Bush St.)

COPPER SHARES—BOSTON.

	Closing prices. Apr. 16.		Closing prices. Apr. 16.
Adventure	1½	Michigan	10½
Ahmeek	60	Mohawk	46½
Allouez	24½	Nevada Con	11¼
Amalgamated	57½	North Butte	52½
Arcadian	3½	Old Dominion	33¼
Atlantic	8½	Osceola	.....
Bingham Con	60	Parrot	17½
Boston Con	11¾	Phœnix	50
Butte Coalition	20½	Quincy	82
Calumet & Arizona	99	Rhode Island	2¾
Calumet & Hecla	635	Santa Fe	1⅝
Centennial	21	Shannon	.....
Con. Mercur	36	Superior & Pittsburg	12
Copper Range	64	Tamarack	58
Daly-West	8½	Trinity	13½
Franklin	6¾	United Copper com	6¼
Granby	9	Utah Copper	.....
Greene-Cananea, ctf	8	Victoria	2¾
Isle Royale	18½	Winona	5
Mass	2¾	Wolverine	125

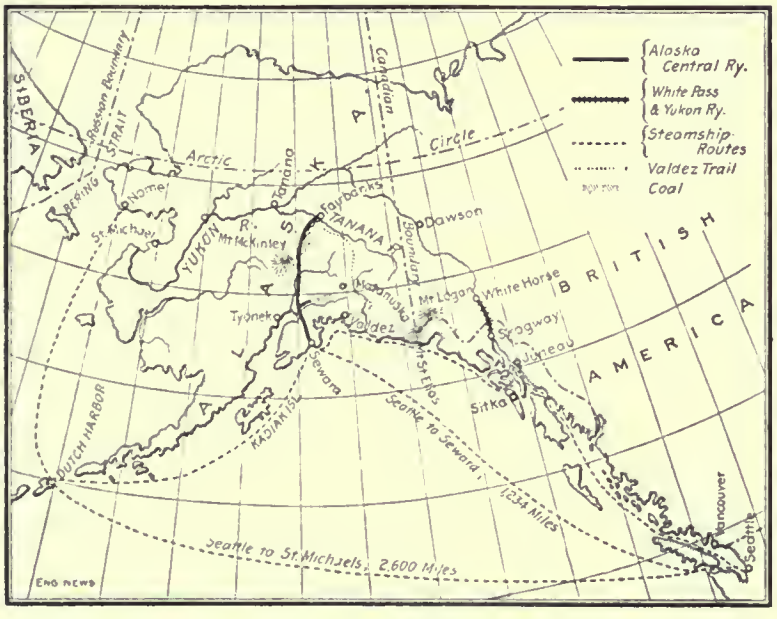
Obituary.

JOHN H. MORCOM, superintendent and one of the owners of the Colorado Iron Works, died at Denver of apoplexy on April 8. He had been with the Colorado Iron Works Co. for the past 25 years, and had many friends in the mining fraternity, both in the United States and Mexico. He leaves a wife, son, and daughter. He was 60 years of age at the time of his death.

General Mining News.

ALASKA.

(Special Correspondence).—Several discoveries of quartz mines have been made on the Seward Peninsula, and a custom mill and sampler will be erected at Nome during the summer.——Representatives of the Guggenheims are stated to have been in the Koujarok last summer, and at least two ditches with unlimited water facilities were acquired with which to carry on placer operations on a large scale. The big electric dredges on Bourbon creek, at Nome, is nearly completed and work will begin early in July. Another big dredge of 2000 cu. yd. capacity per day will be installed on Dry creek, near the Third Beach line, next season. The next mining camp stampede will probably be to Siberia this fall. John Rosene, of the Northwest Siberian Mining & Trading Co., has acquired 500 square miles of the Chuckchi peninsula by a concession from the Czar of Russia. Last year great quartz and placer regions were explored, with wonderful results as to the richness of the country in gold, silver, and copper. A steamship line will operate this summer between Nome and East Cape, and



Map of Alaska.

the various trading ports of the company near Plover bay. It is given out that American miners will be invited to take up and work mining claims in Siberia on a royalty of 10%. Many people are already preparing to go into the country as soon as navigation opens. Word received in Nome from Fairbanks indicates that sluicing operations were carried on this winter until January 16 on Cleary creek. Three feet of gravel on the Oakdale claim of Berger & Sullivan, on Sunset creek, averages 75c. per ton. The pay-streak is in an old stream channel and has to be kept dry by Mammoth pumps. Sixty-five men are working two shifts per day. Newton and Bowles, two Nome prospectors, have found a valuable quartz mine on the Chandelar.

Nome, April 1.

ARIZONA.

YAVAPAI COUNTY.

(Special Correspondence).—The Monte Cristo property, on Groom creek, has resumed operations. About 15 men have been started to work, and more will be added as soon as the mine is unwatered, which is being done as rapidly as possible. The company's stamp-mill is also receiving a thorough overhauling, and will be started in the near future.——Development work will be resumed at once on the Empire mine. A force of mechanics has already begun to repair the machinery and to unwater the shaft.——W. F. Shaw and others, who are developing a group of claims on Wolf creek, report satisfactory progress in the adit being run to cut the main vein.

Prescott, April 12.

CALIFORNIA.

NEVADA COUNTY.

(Special Correspondence).—The Central shaft has passed the 5300-ft. level. A large station has been cut at the 4500 level and three tracks laid. Extensive development work is going on at several points in the lower workings. The vein is showing splendidly at great depth.——A small shaft is being sunk at the Spring Hill mine to connect with the 1500-ft. adit and furnish better ventilation. The adit will be continued for a considerable distance. The vein is four feet wide. The ore is of fair grade.——The Pittsburg Standard M. Co. has forfeited its bond on the Norambagua and the property has reverted to its former owner, George Campbell.——Sluicing has started at the Posey Canyon. A large quantity of loose gravel, rich in gold, is available. ——A. D. Foote has abandoned the bond on the Williams-Ryan-Whiting claims, as a shipment of the ore to a smelter disclosed that the ore was not of good enough grade to warrant working. Foote still holds the Mason ranch and an adjoining 80-acre tract. Williams and associates state that the vein is valuable, and will work it on their own account.——A small quartz vein has been found in the Jenny Lind mine. A large quantity of rich gravel is being developed. Much of the gravel is cemented. ——The shaft at the Kenosha has been unwatered and extensive driving is under way on the 400 level to intersect the rich oreshoots struck at the 300-ft. point.——Sinking progresses steadily at the Normandie in fair ore.——Sinking is still going on at the Midas, and it is thought that the lode will be encountered soon.——Work at the Aurora is going ahead steadily.——Ore is coming from the 200 level in the Golden Gate, and the shaft below that point is being rapidly unwatered. As soon as the vein at the 400 level can be reached driving will be commenced. —— Henry Eckhardt of San Francisco and E. A. Work of Nevada City have bonded the Serius group of claims in the Washington district. Work on the mine will start at once. The bonders expect to install a 10-stamp mill in the near future.——Work will soon be resumed on the Neversweat mine in Willow valley. ——The German mine will be re-opened and extensively developed during the coming summer.——A large force of men is working at the Mountaineer. Good ore is being developed at several points.——W. J. Organ has struck a rich shoot of ore on his claim near the Murchie mine. The discovery was made at a depth of 100 ft.——It is announced that work will be resumed at the Cold Springs and Buckeye mines within a few days. A tunnel will be driven to connect the properties. Thomas Coan is superintendent.—— The Grass Valley Miners' Union has decided to affiliate with the State organization of the Western Federation of Miners.

Grass Valley, April 13.

COLORADO.

CLEAR CREEK COUNTY.

(Special Correspondence).—The first clean-up of bullion at the Hathaway mill, recently erected by the Empire T. Co., was made last week, and it was found that a saving of 92% was made. The average value of the ore being treated does not exceed $5 per ton, while the cost of mining and milling is low and gives a good profit. It is now practically assured that the sulphide ores surrounding Empire can be treated at a handsome profit by the Hathaway process, and as a result a number of owners of mines are going to start work upon milling plants which will be similarly equipped. ——The Charter-Raton M. & M. Co., operating on Breckenridge Mtn., is employing a good force of men in driving the

La Moe adit. The bore is in 950 ft., and progress is being made at the rate of from 4 to 5 ft. per day. According to surveys, the Charter vein will be reached within 50 ft. J. J. Bonner of Georgetown is superintendent.——The Puzzler mine on Young Mtn. is undergoing systematic development and a fair tonnage of ore is being broken. A streak of high-grade gold-silver ore that measures from 12 to 18 in. wide is being stoped, and shipments will soon be made.—— The Coffin mine is producing ore of good grade, the average value of which is $45 per ton. A body of mineral is exposed that is from 4 to 5 ft. wide. It is understood that during the summer months a concentrating plant with a capacity of 25 tons daily will be installed. The Tyler adit is being steadily driven forward, having been advanced 310 ft. Three veins have been intersected, and all show more or less mineral. Driving is in progress upon lode No. 2, and a number of stringers of high-grade ore have been found. T. Tyler is general manager.——The Collins group of three claims and a mill-site is undergoing development. The adit has reached the 400-ft. mark, and a small streak of heavy lead ore is showing. The junction of lode No. 2 will be reached within 30 ft. This property, which is situated on Leavenworth Mtn., recently passed over to the Premier G. M. Co., an Eastern corporation. Alfred Martin of Silver Plume is superintendent.——The Shively adit has been advanced to within 85 ft. of the objective. Great care is being exercised to avoid danger to life, as all of the old maps of the Shively workings have either been lost or destroyed. This adit will tap the 500-ft. level of the Shively shaft, opening for exploitation a vast area of virgin ground.—— Sprousse & Jameson, in charge of the Waldorf M. & L. Co. operations, shipped 12 carloads of $60 silver-lead ore this week.. The ore was sent direct to the Argo smelter in Denver for sale. Work is being prosecuted on the Commonwealth vein, intersected 4800 ft. from the entrance of the Wilcox adit. The ground has been opened for 800 ft. in length, while a stope 200 ft. long is being carried. A body of ore is being followed that measures from 18 in. to 3 ft. in thickness.——The Argentine Central Ry. is again open for traffic, having been snow-bound since the first of last December. Heavy shipments are being sent out from the East Argentine district, and the capacity of the road is being taxed.——The Miller adit on Saxon Mtn. has intersected the extension of the Choctaw vein, whence a heavy production was made a number of years ago. A streak of high-grade ore is showing that is from 12 to 14 in. wide, and a recent sampling gave $78 per ton in silver and lead. ——The Silver Leaf adit on Leavenworth Mtn. is being driven steadily forward, having been advanced 1100 ft. Driving has been started on lode No. 3, and a 4-in. streak of heavy lead ore is being followed. B. J. Martelon of Silver Plume is in charge of the work.——The showing in the Sporting Times mine, Griffith and Alpine Mtn., is improving at a rapid rate. A heavy tonnage of high-grade ore is being mined, the average worth of the same being $87 per ton. The streak measures from 8 to 12 in. wide and the continuity of the shoot has been proved for 35 ft. Stoping has been started and shipments are to be begun next week. A. H. Colburn is owner and operator of this property.—— A 12-in. streak of ore has been uncovered in the winze being sunk on the Silver Cloud, which is being operated through the Victoria adit, Sherman Mtn. The winze is down 35 ft. and as soon as the lift has been completed to the 50-ft. point drifts will be run east and west. From a recent shipment returns of $97 per ton in silver and lead were received.—— Heavy shipments are being made by B. J. O'Connell, leasing 150 ft. below the Victoria adit level on the Mendota. Stoping is in progress upon a streak of lead-zinc ore that measures from 2 to 5 ft. wide, and after separation the lead product averages $70 per ton. No shipments of zinc have been made for several weeks, owing to the low price being paid for that metal.

Georgetown, April 12.

FREMONT COUNTY.

The Empire Zinc Co.'s works are now running at full capacity, after having been partially closed for some months. The United States Smelting Co. is operating again with all its furnaces.

MONTROSE COUNTY.

Surveys have been completed, and it is stated that work shortly will be begun on the construction of a narrow-gauge railroad which is to connect the Denver & Rio Grande railroad at Montrose, Colorado, with the mines of the La Sal Copper-Silver Mining Co. at Cashin, a distance of 70 miles. This road, which will be in operation in a few months, will enable the company to send out its ore at an expense of $2 per ton, as against a charge of $22 per ton for the wagon haul over the present State road. No more ore will be shipped until the railroad is completed, and that which is now being mined is being piled on the dumps, where there is enough ore already to keep the railroad running for several months. Development work is now being actively continued. On the Red Chief the adit has been driven over 1300 ft., and the shaft is in 165 ft. below the adit. Drifts have been run 50 ft. each way at the 100-ft. level, and all are in ore.

PITKIN COUNTY.

The miners have returned to work at the Smuggler and Durant mines, having agreed to accept a temporary reduction in wages equal to about 25c. per day. About 400 men are affected. The properties are large zinc producers and the reduction of wages is due to the low price of that metal.

ROUTT COUNTY.

At the Colorado Mines & Water Co.'s property near Lay, preparations are being made to start the season's work. The ground is being cleared for the dredge, and supplies are being brought in from Rawlins and Rifle. Coal of excellent quality is being opened up and hauled to the dredge..

TELLER COUNTY.

Last Dollar on Bull hill has again entered the producing ranks, under the able direction of the Western Investment Co. During the month of March 22 cars of good-grade ore were shipped. Practically all the levels are being worked. At present there are six sets of sub-lessees operating on the property, most of whom are in good ore. A large amount of development work is in progress. Another property that has recently been taken over by the Western Investment Co. is the Dexter, adjacent to the Last Dollar. The lease was taken since the first of April, but the company is already hoisting some ore.——The annual meeting of the M. & M. Co. was held in Colorado Springs last week, showing an exceedingly prosperous condition of affairs. Net profits of $78,486 were earned during the year, of which amount $75,000 was distributed in dividends among the stockholders. The principal source of revenue was the royalties on the lease on the Little Clara claim, operated by A. E. Humphreys and associates, which amounted to $79,025. In addition, the company received $11,833, this being its 25% share of the terms of the contract. Eleven other lessees are operating on the property. The treasurer's report shows a cash balance on hand of approximately $85,000, against which there stands $6429 due for taxes August 1, and $3500 due in various installments for the Cripple Creek drainage adit.

IDAHO.

IDAHO COUNTY.

The Thunder Mountain mine is being developed, and some ore has been found both west and east in No. 4 adit. The west ore-shoot has been followed for 75 ft. and there is 8 ft. of ore in the heading. A raise has been put up 78 ft. in ore. The east ore-shoot has a face of 9 ft. at a depth of about 310 ft. from the surface. An adit is now being run south from No. 3 adit to intersect this body of ore. As soon as the boiler is installed the mill will be run continuously.

SHOSHONE COUNTY.

(Special Correspondence).—The Snowstorm mine has made a contract with the Amalgamated Copper Co. at Anaconda, Montana, for 100 tons additional to be sent to the Washoe smelter. The Amalgamated has been taking an equal amount for the smelter at Great Falls. With this in-

crease the Snowstorm will now be sending about 400 tons per day to six different smelters of Montana, Washington, and British Columbia. Preparations are now being made to increase the output, as the resumption of smelting in many plants which are now operating a portion only of their furnaces, will necessitate the purchase of more of this silicious ore.——J. H. Ehlers and associates have paid $10,000 more on a $125,000 bond for the Black Bear Fraction property at Black Bear, Idaho. The property is being steadily developed by three shifts, work being concentrated in the deep-level adit, which is expected to strike the Standard ore-shoot, which is believed to cross the Black Bear Fraction property.——It is stated that the Federal Mining & Smelting Co. is soon to reopen its sampler, which was closed last fall. A large tonnage of ore is awaiting treatment at Mace. It is also believed that the Last Chance mine, which made a show of starting some time ago and then withdrew its crew, will resume operations.

Mullan, April 11.

MISSOURI.

JASPER COUNTY.

(Special Correspondence).—The constantly increasing output of the Missouri-Kansas district in the face of a declining price for zinc concentrate has been one of the features of the year's events in this field. In January the weekly production averaged 3630 tons, in February 4036 tons, in March 5430 tons. During the past two weeks the surplus ore that has been accumulated has been largely absorbed. In addition, the activity of buying agents has been more pronounced than at any time for the past six months. Prices, however, for zinc concentrate have been declining in the face of a greater demand until this week showed only $32 per ton for 60% zinc. A few bins sold at a higher base price, but the majority of sales were settled on a base ranging from $32 to $33 per ton. On the contrary, lead ores have been advancing in price. From a minimum of $45 it has passed the $54 mark, with buying exceedingly strong. The result has been great activity among the small producers of lead ores. These small producers being men that were formerly employed in the mines of the larger companies have become operators themselves and have taken up leases in the shallow lead districts, showing that men with a practical knowledge of the mines of this field can take care of themselves at the present low prices, even if the larger properties fail. This has resulted in great activity among the old hollows west of Joplin and along Shoal creek, south of the city. In Leadville Hollow a small company of prospectors took up the lease of the old Arkansas mine, which had been unsuccessful as a mill proposition, and have developed it into one of the best lead and zinc producers of the camp. The property was formerly worked at 165 ft., where the water was especially strong, while the present operators began work on the 145-ft. level, where it is dry. The company has now opened a face of free ore 18 ft. high and 30 ft. wide. A similar occurrence took place at the Hancock mine. This company ceased operations, alleging that the mine was unprofitable as the orebody was too lean. The employees of the mine then leased the ground and mill, and upon driving a new prospect drift opened a face of high-grade zinc-blende. The property is now producing from 30 to 100 tons of concentrate weekly.——The development of the Lounetta ground was brought to the producing stage last week by the starting of the new 150-ton concentrating plant. The company is operating a 12-acre lease, upon which drilling revealed a body of lead and zinc ore 52 ft. in thickness. The shaft was then sunk, which fully developed the drill findings. The property was then worked by hand-jigs for some time, and was a bonanza producer of lead ore until the erection of the mill, in which the zinc ore is treated as well as the lead ore. On an adjoining tract the Barnard Mining Co. has drilled the ground and found the ore at the same level. A shaft is now being sunk to develop the orebody. A concentrating plant will also be constructed.——The Missouri Metals Corporation has purchased the mine and mill of the Pittsburg-Missouri Co., adjoining the old Baltimore ground in Chitwood. The land has been recently drilled and the lease found to be underlaid with a body of sheet-ore. Two shafts have just been finished and the property is now producing ore.——The extension of the Joplin camp to the northward has been accomplished by the development of the Bartlett land by the Cameron Mining Co. A tract of 53 acres has been thoroughly drilled, and a number of holes penetrated an orebody at 146 ft. The shaft that was sunk to develop the lease entered ore at 98 ft., and was in ore to 146 ft., where it again entered barren rock. When driving was started on the 146-ft. level rich ore was developed, and the mine became a good hand-jig producer all through the stages of development. A concentrating plant will be completed this week. The plant is equipped with electrical power and will handle 150 tons per 10-hr. shift.——The Herald Mining Co., operating one of the largest leases in the district at Cave Springs, has closed down its plant in order to tear out its jigging machinery and substitute another form of jig especially adapted to its ore, which is uncommon for this field, as instead of a chert gangue, the ore occurs in a sticky limestone highly dolomitized. The underground work was not interrupted at all, and the ore hoisted is being stored, awaiting the completion of the installation.——Southeast of Joplin, at Tipton Ford, an unusual amount of prospecting has been in progress the past two months, resulting in the opening of a number of new orebodies. On the Barbee-Gregg land, Donahue & Jenkins put down a number of drill-holes, all of which penetrated two runs of ore. In one hole a continuous run was found from 15 to 150 ft. A shaft has been started on this hole.——On the Newdigger land a surface deposit of lead carbonate has been discovered and followed back into the hill some 50 ft. A shaft 6 ft. deep only 100 ft. away opened a similar deposit. These deposits are among the richest shallow discoveries ever made south of Joplin.——On an adjoining tract, belonging to Murphy & Hewett, drilling has developed two runs of ore, one from 20 to 45 ft. and a second 120 to 180 ft. The cuttings showed both galena and zinc-blende.——On the Armil land, on Shoal creek, Jack Armil and associates have developed a deposit of zinc-blende at the 165-ft. level. The strike was made in new territory. The ore runs 11% zinc-blende, and will be treated in a new concentrating plant in course of erection.

Sketch Map Showing Position of Joplin.

Joplin, April 13.

NEVADA.

CHURCHILL COUNTY.

(Special Correspondence).—Through the broad-mindedness of both mine owners and their employees, the possibilities of a strike have been averted and mining operations have again settled down to a progressive basis in the Seven Troughs district. The operators recently declared their intention of reducing the wages from the $5 flat rate to the scale adopted by the Consolidated companies of Goldfield. The miners' union immediately sent delegates to confer with representatives of the mine owners, and succeeded in effecting a compromise which seems highly satisfactory to both parties. The scale adopted is graduated as follows:

Muckers and top-men receive $4 per day; miners for drifts and stopes, $4.25; for shafts and raises, $4.50; engineers, carpenters, and blacksmiths, $5; all wet work 50c. per day extra. With this question settled, nearly all of the developing properties have resumed work, with several new enterprises coming to the front. As a result, numerous rich strikes have been reported during the past week.——The Kindergarten has further increased in value by disclosing another ore-shoot in the east drift from the 125-ft. level that far surpasses any of the ore thus far extracted. The occurrence is in a hard quartz containing sulphides and free gold. The mill for this company is rapidly nearing completion, and it is the expectation of the owners to have it in operation early in May.——The hoisting equipment and head-frame for the Gaynor lease has been erected and will be in operation within a few days.——The Stoker lease on the Therein has encountered a high-grade streak on the hanging wall of the incline at a depth of 225 ft. and is stripping the adjacent material until a sufficient amount has been uncovered to extract for shipment.——On the Mazuma Hills great activity prevails. The mining company has again started development work, after clearing away the shipping ore during the recent shut-down, and is increasing the working force preparatory to supplying the mill, which is to be completed at an early date.——The Reagan-Hayes lease, at a depth of 27 ft. in the winze from the 65-ft. level about 150 ft. north of their working shaft, has opened a rich shoot of ore ranging in width from 8 to 20 in. A nugget extracted a few days ago weighed about 1½ oz. and showed but little gangue. A carload shipment went out from this property early in the month.——The Arnett-Potter lease, lately acquired, has by a system of trenching exposed a lode which is thought to be the one on which the mining company is working. Several small specimens showing free gold have been found, while the lode pans across its entire width. A guarantee of $10,000 for development purposes was required by the mining company before the lease was granted.——A block of ground was this week let which means much for the economic importance of the camp. It has been acquired by G. H. Hayes and associates of Goldfield, and lies between the Reagan-Hayes block and the Mazuma Hills main tunnel. A lode has already been exposed showing good ore, and with development it is thought some important finds will be made. It is understood the parties in possession will start active development at once. Other lessees on this property are making good headway and proving the presence of a fair grade of milling ore. Most of the leases are for two years.——The George-English lease on the Fine Gold in an open-cut west of the lower adit has opened a 12-in. stringer, 6 in. of which is of high grade.——Reports come from the northern and southern ends of the district of rich finds on the Little Hero, Cæsar, Golden Treasure, Annie, and Big Dipper claims, at Farrell and Vernon.

Seven Troughs, April 14.

ESMERALDA COUNTY.

A contract has been signed for a 600-ton Butters patent vacuum-filter plant of 300 leaves, for the Goldfield Con. Mines Co. at Goldfield. This equipment is to be ready for operation by Nov. 1. F. L. Bosqui is consulting metallurgist to the company.——From the Tonopah district there was shipped 3925 tons of ore during the week ending March 31, according to the report of the Tonopah & Goldfield railroad. The following mines contributed: Tonopah Mining Co., 2789 tons to the mill at Miller; Belmont, 733 to the mill at Miller; Midway, 189 to the Belmont mill; Tonopah Extension, 101 to the Western Ore Purchasing Co.; MacNamara, 50 tons to the Western Ore Purchasing company.

LINCOLN COUNTY.

A discovery of rich galena and gold-bearing quartz has been made in Eldorado canyon, near Nelson. An 18-in. vein of solid galena and a quartz vein showing free gold have been found by prospectors, who are now developing the find. The claim is just west of the McGann mine. Nelson is 20 miles north of Searchlight and 35 miles east-southeast of Las Vegas.

NEW MEXICO.

SIERRA COUNTY.

(Special Correspondence).—The Good Luck mine is now operating with 30 men, doing development work. Another body of lead and silver ore was found and the outlook is encouraging. Later on they expect to erect a 100-ton mill to treat the ore from the mine. The ore runs high in lead and silver. About 900 ft. of development work has been done in ore. J. H. Elspass is manager and T. J. McKenna superintendent.

Lake Valley, April 2.

OKLAHOMA.

OTTAWA COUNTY.

The development of the Oklahoma ore deposits began in 1904 with the erection of two concentrating plants; in 1905 three more were added; in 1906 there were 16, and in 1907 there were 25 plants with a capacity varying from 100 to 300 tons. This increase in number of plants, however, has not been so productive of ore as many of the smaller camps with a less number of mills. The camp south of Baxter Springs, which was first developed, has proved to be well mineralized territory, and the deposits of ore are large.—— Many of the mills were idle for months, owing to bad management, but recently a better tone seems to have come to the camp, and a number of the properties are being worked by better methods. As a result there is rising up in the whole camp a number of small producers that are developing ground without expending money for plants before they are needed. The Dark Horse property is now being operated with hand-jigs with good results, while the Mozaska, northeast of it, is also a good producer on a small scale. There are other properties that might be placed in a productive state if the operations were confined to the actual production of the ore as development was carried on, instead of selling stock and building concentrating plants before the orebody is sufficiently developed.——The latest development is being done north of Miami, where some rich properties have been indicated by recent drilling and shaft-sinking. The New State lease has sufficiently developed the ground to show a large body of workable ore. The ore occurs in connection with a large quantity of bituminous matter, which makes its separation a hard proposition, but the percentage of ore to the gangue runs high, thus insuring a large return if the separation is complete.——The Gordon Mining Co. has sunk five shafts to an orebody that was discovered by drilling, and has now erected a 300-ton concentrating plant.——The Old Chief property has also been developed and a concentrating plant has been erected.

WASHINGTON.

FERRY COUNTY.

(Special Correspondence).—The Copper Key Mining Co. is applying for patents for the Copper Key, Triune, Maggie Fraction, Spokane, Aunt Spokane, Uncle Spokane, and Sister Spokane lode claims on Belcher Mtn.——The Summit M. & M. Co. is about to resume work on the Summit mine. The company owns a group, of which the Summit is the principal claim. A shaft is down on a quartz-vein, in which small deposits of high-grade copper and silver-lead ore occur. Two levels have been opened, the deepest being about 150 ft. below the collar of the shaft. On the lower level there is a chance to open up a good pay-shoot. The Keller & Indiana Con. Smelting Co. is about ready to blow in its furnaces and buy ore. A contract has been let for haulage of coke from Creston, a point 22 miles distant on the Washington Central railway.——The Byrne Co. has developed a body of ore assaying about $30 per ton and is following it on the adit level.——The Illinois Copper M. & M. Co. is driving an adit on the vein and reports a gradual improvement.——At Park City the Hercules adit is in 410 ft. and getting into the vein, but no ore has yet been found. ——The first carload of ore from the Railroad mine, two miles north of Laurier, will be shipped as soon as the wagon-road to the railway is in good condition for haulage. ——The Little Kitten mine, under operation by the Mohawk Co., on the west side of Kettle river, is showing up better

than was expected and promises to make a good paying venture.

Republic, April 11.

OKANOGAN COUNTY.

(Special Correspondence).—Men have been put to work drilling out the frozen charges of the Sullivan smelter, which led to the supposition that the smelter was to resume. One furnace may be blown in to dispose of the surplus ore, amounting to about 2000 tons, but after that is disposed of the plant will be shut down indefinitely. The mines will not be operated until the price of lead is high enough to warrant the treating of the refractory ores of the district.

Spokane, April 11.

CANADA.

ONTARIO.

(Special Correspondence).—The policy of developing its silver veins at depth, instead of mining from the surface, as practiced by many of the Cobalt properties, is beginning to bring good results to the Cobalt Central management. At the No. 2 level of the Big Pete shaft five veins are now being worked and high-grade ore extracted, whereas on the surface these veins were worthless. The richness of the ore in the low levels is shown by the result of the operations of the Cobalt Central's concentrating plant on April 2, when from 47 tons treated the yield in silver was 27,350 oz., valued at $15,179. On Lot 38 of the Cobalt Central mines a new vein has been stripped on the surface which shows a width of 20 ft. of good concentrating ore. A shaft is being sunk on this vein for the purpose of developing it at depth.

BRITISH COLUMBIA.

Regular shipments of bullion and high-grade concentrates are being made from Hedley. The most important claims in the camp are the Nickle Plate and the Sunnyside, owned and operated by the Yale Mining Co., whose property also includes some twenty-five other claims. Upward of a million dollars has been expended by this company and its associate, the Daly Reduction Co., in developing the Nickel Plate and Sunnyside. While there is a large amount of underground development proving the orebodies in depth, the ore supply up to the present has been taken from large glory holes on the surface. These glory holes are simply large quarries cutting into the surface of the vein, which is fully 75 ft. thick and proved by the excavations to be continuous for a distance of over 3000 ft.. The ore is treated by the Daly Reduction Co. in a 40-stamp mill and cyanide plant in the valley below. The capacity of this mill is about 3500 tons per month. The mine and mill are run by water-power obtained from a flume three miles long. The company owns an electric tram line about a mile and a half long to carry the ore from the mine to the tipple, and a gravity tram-line about 10,000 ft. in length and some 4000 ft. vertical height, which carries the ore in 5-ton skips to the mill. It is an interesting fact that in the mining of these ores from glory holes all the rock has been put through the mill, without any discard as waste. The production of the mines last year in bullion was $700,000.——The Pollock mines, owned and operated by the Pollock Mines Co. Ltd., which lie on Henry creek, two miles to the west of Hedley, on the opposite side of the Similkameen river, have a considerable amount of development already done. ——The Kingston Gold Mining Co. has an excellent property adjoining the Nickel Plate group, which has been well explored and is now arriving at the shipping stage, and with the advent of the Great Northern to Hedley the Kingston will be a big shipper.——The Golden's Own, lying northeasterly from the Nickel Plate, which is well known as a valuable property, is now rapidly developing into a producer. It is owned by Marks, Broadhagen, and others, and is a free-milling property, similar to the Nickel Plate. Machinery is now on the ground for a stamp-mill, the work of getting material for construction is being rushed, and the mill is expected to be in operation in the early summer.

The adit in the Blue Bird is in about 70 ft., and the vein in the face is 4½ ft. wide and is all high-grade ore. The vein is strong and well defined from the portal to the breast of the adit. The work of extending the adit continues and is making better progress, now that a steam drill is being used. The lessees have requested the Columbia & Western railway to put in a spur at the Homestake, where formerly there was a spur. At present the ore has to be hauled to the Spitzee, a considerable distance, but when the spur is completed the ore will only have to be hauled a few hundred feet. W. Whitford and C. Jenkin have bought the quarter interest owned by W. Arscott in the lease. This gives them a three-quarters interest. Under the terms of the lease the most men that can be worked at one time is eight. The full number will be put to work just as soon as the spur is put in.

It will be seen that the Iron Horse joined the shipping list this week. This property has been leased to M. A. Henderson and associates.——A trial shipment of Cobalt silver ore has been made to the Trail smelter from the Nancy-Helen mines. The Cobalt smelting ore has heretofore been treated in the United States, but if it is found that it can be profitably treated in Western Canada, regular shipments will be maintained.——The Crescent mine, a Chicago enterprise, has ceased work. Their plan of operations is to be modified. A carload of high-grade ore was shipped from the property in February.——The old Blue Bell mine, on Kootenay lake, from which the early trappers got lead for their bullets, is to be worked on a larger scale this season. ——A London-Nelson syndicate has leased the Hall mine at Nelson and will begin work as soon as the snow goes off the hill.——The Big Bend Mica Co. has been organized to work 1400 acres of mica ground north of Revelstoke.

The Evancon Mine, in the Val D'Aosta. The Only Gold Mine in Italy.

Following is the tonnage of ore shipped from and crushed at the mines of Rossland for the week ending April 4, and for the year to date:

Mine.	Week.	Year.
Centre Star	3,960	46,598
Le Roi	1,680	23,734
Le Roi No. 2	490	8,418
Evening Star	31	428
Iron Horse	38	38
Blue Bird	....	30
Totals	6,199	79,246

The district shipments for the week were as follows: Boundary, 24,687 tons; Rossland, 6199; Slocan-Kootenay, 1476. Total for the week, 32,362 tons.——At the smelter of the Consolidated company there was received during the past week 5224 tons. Besides that which was sent from Rossland, ore was received from other mines as follows: St. Eugene, 419 tons; Snowstorm, 487; Richmond, 28; Rambler-Cariboo, 24; Nugget, 24; Whitewater, 46; Silver Cup, 335; Mother Lode, 15 tons. The Granby smelter received 24,687 tons from the Granby mines at Phoenix. The Le Roi smelter at Northport received shipments as follows: Le Roi, 1756 tons; First Thought, 63; total, 1819 tons.

Special Correspondence.

LONDON.

Rio Tinto Report.—Cause of Withholding Information.—Ooregum Gold Mining Co.—Condition of Oroya Brownhill Mine.

It is always regretted by mining engineers and metallurgists that the force of circumstances prevents the publication of details relating to the development of the Rio Tinto mine, and the methods of treating the ore. The management and direction of this mine are unequalled, and an account of the experience gained there would be of great value to everybody. The secrecy maintained is not due to personal whim, but solely as a safeguard against the rapacity of the tax collector. The Spanish Government treats the mine-owners of Huelva as aliens that should be taxed to the utmost, and taxes have to be paid almost every time the ore is moved during treatment. The publication of anything like a full description of the methods of mining and treating the ore would have the effect of bringing down a swarm of tax-gatherers. It is not only the Rio Tinto company that observes the policy of silence. The other English companies, such as the Tharsis and Mason & Barry, do the same. The chairman of the Rio Tinto, C. W. Fielding, has experienced similar difficulties, if not worse, in California, in connection with the Mountain Copper Co. Your readers are well aware how this company has been treated by the politicians. Consequently the report for 1907, just issued, gives as usual only a bare outline of the results. After paying all expenses and making liberal allowances for depreciation of plant, a net profit of £1,744,596 was made, of which £79,000 has been distributed as dividend on the preference and £1,640,625 on the ordinary shares, being at the rate of 87½%. This rate compares with 110% during 1905 and 1906, and considering the current history of the copper market, may be thought highly satisfactory. In fact, it displays the sagacity of the management in connection with their selling contracts. The amount of ore extracted during the year was 1,906,948 long tons, of which 641,858 tons were cupriferous pyrite intended for shipment to Germany, Great Britain, and the United States. The actual amount of this class of ore shipped during the year was 607,944 tons, of which 332,259 tons went to Germany, 116,035 tons to Great Britain, and 159,650 tons to the United States. Less goes to Great Britain than formerly, as the United Alkali Co., one of the chief customers, now possesses mines of its own in Spain. Of the remaining output, 1,265,090 tons was held for local treatment. Some of this is smelted, and the remainder leached. After the copper is extracted the leached ore is sold for its sulphur content. The total amount of copper produced during the year was 32,317 tons, of which 21,251 tons was produced at the works and 11,066 tons sold in the pyrite shipped.

After having suffered from drought for some years, the company now has to report that its water supply is in an extremely satisfactory state, owing to the unprecedented rains of the early winter. These rains caused the subsidence of part of the land adjoining the South lode and a great many dwellings were ruined. This caused some expense to the company in rebuilding houses elsewhere, but on the other hand the subsidence is welcome, as it allows of considerable economy in mining by an extension of the open-cast system. Walter J. Browning, well known in Mexico, was appointed general manager of the Rio Tinto last autumn, in succession to W. A. Carlyle.

E. H. Garthwaite in your issue of March 14 calls in question some remarks of mine relating to the population of Rhodesia. I am glad that any words of mine have been the cause of Mr. Garthwaite's sending you a contribution relating to the country in which he served the British South Africa Co. as chief engineer. Unfortunately, however, he has mistaken my point, and he is arguing on the same side as myself. The Government of Rhodesia has always deplored the scarcity of white settlers. On one occasion Generai Booth took them at their word and offered to ship out a large supply of 'out-of-works,' 'ne'er-do-weels,' and ex-criminals. Both the Government and the settlers themselves were immediately up in arms against such a proposition, and it was promptiy vetoed. My point is that the development of a new country is not as a rule done by the comfortable and respectable portion of the community, but by those who ieave their country for their country's good.

The Ooregum Gold Mining Co. has during the last six years worked on much lower grade quartz than the adjoining mines in the Mysore goldfield. During 1907 the ore milled was 124,160 long tons, yielding 64,084 bullion ounces. In addition 9068 oz. was obtained by cyaniding 89,164 tons of tailing, and 410 oz. recovered in dismantling one of the old mills. The total production therefore was 73,562 oz., which realized £278,898. It will be seen that the average yield is only just over 12 dwt., as compared with just under 18 dwt. at the Nundydroog, details of which I gave last week. The profit on the year's working was £94,454, out of which over £50,000 has been written off for depreciation, etc., leaving a disposable amount of £$40,922. Out of this dividends of 17½% on the preference and 7½% on the ordinary shares have been paid. In writing of the Mysore Gold Mining Co. a fortnight ago, I mentioned that in future John Taylor & Sons' companies had decided to pay for all new improvements out of revenue, instead of issuing new shares. The cause of this new policy is very definitely seen by examining the result of the issue of shares in the Ooregum company made last May. Out of 137,000 new shares then offered only 38,544 were taken up.

As I mentioned in a recent issue, the orebodies at the Oroya Brownhill mine, in West Australia, are showing signs of rapid exhaustion, but there is enough left to last during the current year. During 1907 the tonnage treated was 133,395 short tons, and the gold won was 102,302 fine ounces. The working costs, exclusive of development, depreciation, and office expenses, were 19s. 8½d. The profit was £259,775, and £267,187 was distributed as dividends. Active prospecting in several parts of the mine has been and is still being conducted, and it is hoped that further deposits may be discovered.

JOHANNESBURG, TRANSVAAL.

Negotiating for Malagasy Labor.—Illicit Liquor Traffic.—Bonanza Mine Closed.—Miner's Anaemia in Rand Mines.—Brakpan Shaft Cuts Reef.—New Method of Shaft Plumbing.—Gordon Drill in Practice.—Proposed Amalgamation of Rand Mines.

There is probably no more inconsistent government than that of the Transvaal, and during the past fortnight we have had one of the most startling examples of their inconsistency. As is well known, the Het Volk party, like the Liberal party in Great Britain, climbed into power on the Chinese labor question. In the eyes of the Boer party, one of the greatest crimes was that of introducing Chinese on the Rand for working the mines. For some time past there have been rumors that the Government of the Transvaal has been negotiating with the French Government for labor from Madagascar. Why the Malagasy laborers of Madagascar (which would prove inferior to coolie labor) should be allowed on the Rand and the Chinese forbidden to come, is a problem which none save the politicians of the Boer party have been able to fathom. The French Government will no doubt refuse to allow Malagasy labor to come to the Rand and nothing will result from the incident, but it is a good example of the inconsistency of the present Government.

At the moment there is sufficient Kaffir labor for the Rand mines, but in looking forward there are signs of scarcity, especially if pronounced prosperity should return to South Africa. It is to be hoped that when the Government finds itself at a loss to procure sufficient labor it will admit the error of its ways and allow the most satisfactory we have yet had, namely, the Chinese, to return to the Rand.

On account of the continued depression and the increased

number of Kaffirs at work, there has been a large increase of late in the illicit liquor traffic. The Kaffirs, especially on Sundays, will pay a high price for liquor in any form, and as the temptation to a man or woman out of employment, with no chance of finding work, is very great, many of these people go in for selling liquor illicitly to natives. As long as they are not caught, the rewards for being in this trade are enticing, but when the law gets hold of the illicit liquor dealer he has a hard time. After the offense has been proved, which is at times a difficult matter, the culprit is condemned to prison at hard labor for periods of six months to two years. No fine can be paid for this offense, as the law requires imprisonment. On account of a large number of convictions for illicit liquor dealing, some of the Government orators have lately been defending their 'beer bill.' By this bill it would have been possible to supply natives with liquor, had the bill become a law. The argument of Het Volk is that it would be better for the natives to be supplied with liquor under Government control than to buy the vile stuff which the illicit liquor dealers supply to the Kaffirs. The opposition (namely, the Progressive party) takes an entirely different view of the question, and is pledged to the principle of total prohibition of liquor to natives. On the whole, the people of the

Traveling in Rhodesia.

country are inclined to agree with the Progressive party on this point.

The Bonanza mine has died at last. After running two or three years longer than the official 'life,' the concern has ceased to produce gold. But the reduction plant is as active as ever, for the Robinson Central Deep, an adjoining mine, has taken over the mill. This gives the Robinson Central Deep an additional 50 heavy stamps, besides the 100 stamps now at work elsewhere. Before a commission now sitting in Johannesburg important evidence was given last week by one of the medical authorities of the Rand, on the subject of ankylastomiasis (miner's anaemia). On account of the acid water in the mines, and the dry climate, this disease has not spread as rapidly as it would in a wet country, or in mines where the water was alkaline. Nevertheless it is bad enough, and the mine doctors have been warned to look out for it. Some of the Kaffirs arriving on the Rand from Central and East Africa suffered greatly from this disease. From 60 to 70% of the new men are sometimes affected. The white men in the mines catch the disease through lack of care. On account of the information supplied, and the precautions taken, ankylastomiasis has not so far attacked a large number of the under-ground workers on the Rand.

At the Brakpan mine the reef was cut on September 30 by shaft No. 1, at a depth of 3096 ft. The ore at the point of intersection assayed only 2 dwt. across 2 ft. of vein, but later development revealed 9 dwt. ore 60 ft. away, and 120 ft. from the shaft the value had risen to 31 dwt. across 24½ in. of vein. It is thus seen how irregular is the distribution of gold in the Rand deep mines. In connecting the surface and under-ground surveys at this mine a new method of shaft-plumbing was employed, which is correct to within one minute at a depth of over 3000 ft. This system of shaft-plumbing was devised by Frank Roberts, manager of the Knight's Central mine. Despite the success of the Gordon drill in the recent competition, it is not proving so successful in actual practice. Its defect consists in the necessity for turning the drill by hand, imposing a duty upon the workman to which the inattentive Kaffir is unequal.

Some very sarcastic letters have appeared in the press lately regarding the huge amalgamation schemes that have been suggested. The proposed East Rand Proprietary amalgamation has brought out the most opposition. As is well known, the 'outcrop' companies of this group, such as the Angelo, Dreifontein, Cason, and New Comet mines, are as good as any on the Rand. The grade of ore is satisfactory, they are all profit earners and dividend payers. But with the deep-level companies it is different. Take the Angelo Deep for instance. They have developed 831,936 tons of a value of 3.55 dwt. and 889,575 tons of a value of 3.97 dwt. From this huge tonnage 13s. per ton could be extracted, and with present day working costs this is useless. The outlook for the rest of the deep-level ground is not much better. There has been a distinct impoverishment with depth. It is now proposed to combine all these mines, both 'outcrops' and 'deep-levels,' into one huge concern, to be known as the East Rand Proprietary Mines. For the shareholders of the deep levels, whose ground is of little value, this scheme is satisfactory, but it is distinctly unfair for the people who have bought the 'outcrop' shares on the basis of a 5 to 6% return on their money. It would have paid them better to have bought Consols in the first place. Several correspondents in the local press have pointed out that this amalgamation will be rushed through before the shareholders in Europe and elsewhere have had sufficient time to realize the significance of the proposals. From a mining standpoint a large area with big stamping plants is desirable, and the Rand should have been started off in this way. It is rather late, say the correspondents, now that the rich 'outcrop' companies are half worked out, to come forward with such propositions. Let the 'deep-level' claims be amalgamated into huge mines, but don't try to ruin the shareholders of the 'outcrop' companies by putting them into the deep-levels. To do so is sheer stock exchange jugglery, and will bring the Transvaal into worse repute than at present.

Another problem which has agitated the community more than usual is that of the unemployed and destitute. So intense has the suffering become that public meetings have been called to save many of the people from starvation. At such a time people are liable to become emotional and let their hearts run away with their heads. As State Secretary Smuts said at a mass meeting called to consider the problem, the question of the unemployed in the Transvaal is more difficult than in most other parts of the world. The Rand has more or less spoiled the white men for hard labor. Unless he is given an impossible wage the white man will not do manual toil for any long period. The standard of living has been set so high that the workingman has forgotten the virtue of frugality. Smut's statement of the Government's experience in railroad construction well illustrates the difficulty of getting the white man to work in this country. In the construction of a section of a railroad only white men were employed, at a wage of 6s. per day, which is about 2½ to 3 times as high a wage as the Kaffir is paid. The white men did not remain long at this work, and the experiment was put down as a failure. The Government is not discouraged, for it is its fixed policy to extend the use of white labor. They are offering to take on white men for further road construction at 4s. per day, but for this offer they are being greatly abused by the white people. There is a large number of unemployed, both among Dutch and British, who are fast becoming pauperized by the doles of charity that have been given them. As long as they receive enough to live on they will never work. The community is fast learning that work must be

found for the white men, and all who can work and won't work must be allowed to go under. The curse of the place as far as the unemployed white man is concerned is the Kaffir. The black man is on so much lower a scale, and is so protected by the Government, that the white man cannot hope to compete with him as an unskilled laborer. The long talked of report of the commission appointed by the Government to enquire into the question of labor for the mines has been published. If carried ont, the plan of the majority would speedily ruin the Transvaal. The gist of the report is to entirely exclude Kaffir labor from the mines, within a short period, and employ white labor only. One member handed in a minority report, in which he unmercifully ridicules the report of the majority and shows how impracticable it is. The general opinion is that the Government will scarcely notice the majority report, for they must recognize that it is academic and hypothetical. The pity of it is that so much time and money should have been wasted.

DENVER, COLORADO.

Strong Feeling in Telluride. — Activity in Upper Clear Creek. — Record Shipments at Cripple Creek. —Development Work on Republican Mountain.—High-Grade Ore in the Accident Mine.

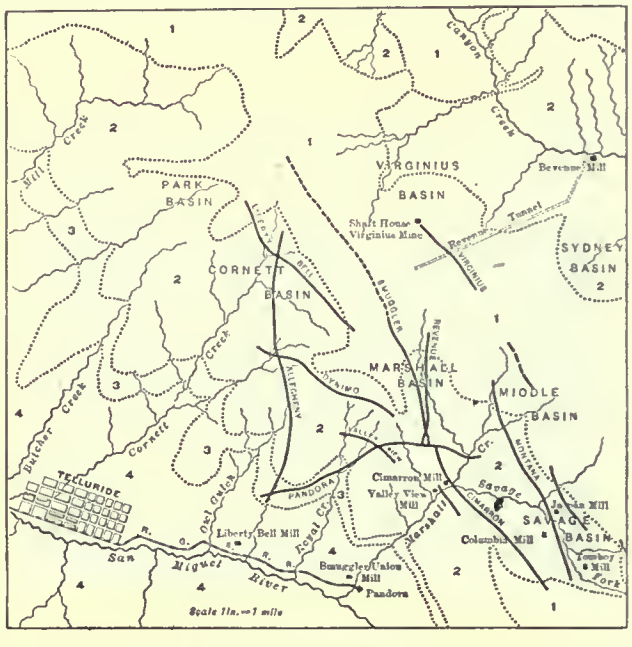
The unsuccessful attempt to murder General Bulkeley Wells at the Smuggler Union has aroused the whole San Juan district. A reward of $16,500 is offered for the capture of the person or persons implicated. The police and private detectives are working on the case, trying to determine whether it can be traced to the recent trouble with 'high-graders' in the camp, or to the coming trial of Stephen Adams for the murder of Arthur L. Collins, the former general manager of the Smuggler Union.

The Precious Metals corporation of Silverton has sold its properties on Mill creek, near Chattanooga, to J. R. Allen of New York. A small force of men has been put to work on the property. The Upper Clear Creek district becomes more active as spring advances. Several sales of mining properties are recorded, among which is the transfer of the Red Oak Mining & Milling Co.'s property near Georgetown to C. H. Poirier and associates, of St. Louis, Mo. The Becky Sharp mine in Russell gulch has been leased to Jones and Griffith, who are now carefully prospecting the property. The Queen of the West and the Robert Emmet mines in Chase gulch are being unwatered and the shafts re-timbered by Bradley Bernard and associates. George S. Dubois, the discoverer of the Lost Bullion mine near Silver City, N. M., has escaped further prosecution by the Government for using the mails to defraud. He was killed in a quarrel at Ballarat. Boulder county is rapidly becoming notorious through such transactions as those of W. W. Degge, and the Lost Bullion mine swindle.

A carload of machinery has arrived for the Arctic mill, which is now in course of construction. The erection of the electrical machinery on the Colorado Co.'s two new Bucyrus dredges on the Swan is nearly completed. Active development work has been started by the Golden Glory Tunnel Mining Co. on Saxon Mtn. The adit is now 600 ft. long, and it is expected that the Bellevue-Hudson vein will be encountered within 150 ft. On the Lebanon adit property, situated on Republican Mtn., a raise is being made on lode No. 10, which was intersected at 1000 ft. from the portal. A good orebody is being developed and occasional shipments made. Work has been resumed on the McKinley Mining & Milling Co.'s property, situated on Bard creek, Lincoln Mtn. The work is being done by contract on the McKinley adit, which is now 325 ft. long. A streak of lead ore from 12 to 18 in. wide was recently found, and this is being explored by drifts. The McKinley lies to the west, and is an extension of the Ramsdell mine, which has been steadily developed during the last two years.

Cripple Creek has established another record by producing 61,062 tons during March. The gross value was $1,385,177, which is an increase of $142,864 over the value of the February output. The United States Reduction & Refining Co. has started up its Canyon City plant in order to handle the tonnage for April, which promises to exceed that of March. The low freight and treatment charges continue, and competition between the U. S. Smelting & Refining Co. and the Golden Cycle is very keen. Operators in Cripple Creek are enjoying the unusual condition of having more miners looking for work than can be taken on. This is especially advantageons in the drainage adit work, as it makes it possible to keep the force up to a high degree of efficiency. The adit is now in 1960 feet.

Flaacks, Mullen & Co., operating on the south end of the Rigi group on Battle Mtn., and adjoining the Portland mine, are shipping a carload per week, assaying about $50 per ton. The ore is being broken at two places on the 50-ft. level between 6 and 8 ft. wide. The ore shipped out since the lessees started work three months ago varies from $25 to $90 per ton, and carries syivanite. Stoping is in progress and a winze is being sunk on ore. It is expected that development work will be started on the 100-ft. level. The shaft has been sunk to a depth of 500 ft. A 3-ft. body of ore with a narrow streak of exceptionally high grade has been found



Sketch Map of Telluride District, Colorado.

Not Classified as to Geologic Age. { 1 Rhyolites and Andesites. Eocene 3 San Miguel Conglomerate
2 San Juan Formation. Andesitic Breccia. Jurassic and Cretaceous. 4 Shales and Sandstones.

in the Accident mine on the west slope of Gold hill, adjacent to the Index and Pointer mines. The find was made near the shaft on the 300-ft. level, and consists of tellurides.

The feeling against Stephen Adams and the Western Federation of Miners is intense in Telluride since the unsuccessful attempt to murder Bulkley Wells, manager of the Smuggler-Union mine. For this reason Mr. Hilton, the attorney representing Adams, has asked for a change of venue. The application is simply another excuse for delay in a matter which gets worse the longer it is fooled with. In general, the district is active, especially on Mill creek and Deep creek, where development has been in progress all winter. The Little Mary Mining Co. has leased two batteries in the old Pandora mill, and is milling all its ore there. The Calumet-Telluride Gold Mining Co. has developed a large body of ore on its property in Chapman gulch, and is making arrangements to build a mill.

The monthly pay-roll for the Cripple Creek district was the largest since 1903, and yet there is a large number of idle men in the camp. The water flowing from the El Paso tunnel is steadily decreasing. Both the Elkton and the Mary McKinney mines have been able to resume work on their lowest levels without pumping. A 60-day prospecting permit on the Night Hawk fraction has been given to Pleasants, Prevett & Simpson. This property has been idle for

the past six years. The Golden Cycle Co. has been obliged to reduce the output of its mine for the present, as the mill at Colorado City is overstocked with ore. In the meantime, development will be pushed on the lowest level.

The suit arising from the sale of the Independence mine by the late W. S. Stratton to the Venture Corporation of London has been dismissed from court on the ground of insufficient evidence. The plaintiff, J. H. T. Deever, alleged that he had been engaged by the agent of the Venture Corporation to determine whether the mine had been 'salted' before the corporation purchased it. The famous $1,000,000 suit brought by James Doyle against James Burns has been postponed by mutual agreement. U. S. District Attorney Ward has dismissed the case against John A. Porter and others, of Durango, who were charged with conspiracy against the U. S. Government in obtaining 1080 acres of coal land by fraudulent means. The case is simply dropped until further investigations can be made, when, if the evidence warrant conviction, the matter will be pushed.

Work on the Central Power Co.'s plant at Shoshone has been stopped temporarily. The 250 men employed went on a strike because the company refused to grant the scale of wages paid last fall. A contract has been let by the Gauntlet Gold Mining Co., of Idaho Springs, to G. D. Kaye, for extending the lateral from the Newhouse tunnel along the Mammoth vein 500 ft. farther, making 1500 ft. in all. This is a low-grade milling proposition. The Eastern Colorado Power Co. has begun to put its various camps in readiness for the large force of men to be employed on the power-plant project in Middle Boulder creek. The Newton mine dump is being treated in the Allan mill at Idaho Springs, and is yielding a fair profit. The Rollins mill, in Gamble gulch, near Central City, has been purchased by the Gilpin-Independence Mining Co., which is operating the Gold Flint property. Some necessary improvements are now being made.

SALT LAKE, UTAH.

United States Lead Smelter.—Report of the Bingham Consolidated.—Resumption of Operations at Various Mines.—Railroad to Alta Re-opened.

The United States lead smelter will not resume until about July 1. It will take time to construct the roasting plant, and to make alterations in the flue system. The company will begin the purchase of ore within a month. About 130 men are employed on construction.

The work of remodeling the Sunshine mill, at Sunshine, will commence soon. A slime plant similar to the one at the Consolidated Mercur is to be installed. At a special meeting last week of shareholders of the Ohio-Kentucky Mining Co. the capital stock was increased from 150,000 shares of the par value of $1. to 600,000 shares of $5. The properties of this company are at Pioche, where a vigorous campaign of development is in progress. The headquarters of the company are in Salt Lake. The annual meeting of shareholders of the May Day Mining & Milling Co. resulted in the retention of all but two of the former directors and the re-election of John Dern of Salt Lake as president. The receipts from ore sales, including $9378 at the beginning, were $161,016. Dividends amounting to $64,000 were paid, and the cash on hand April 1 was $9084. The company claims that three years' supply of ore, based on last year's production, is blocked out. The Garfield concentrating mill of the Boston Consolidated is doing splendid work. During the first week of April the extraction was 71 per cent.

The operations of the Bingham Consolidated M. & S. Co., according to an official circular, were not very profitable during 1907, having suffered a loss of $277,000. The total liabilities are stated to be $770,185. The smelter alone ran behind more than $2000 monthly. The annual report of the Utah Consolidated for 1907 has also been issued and shows net earnings of $3.93 per share, against $9.45 per share in 1906. The income account is as follows: Metal sales, $3,744,532; expenses, $227,152; net proceeds, $3,517,380; bullion, etc., receipts, total, $4,608,913; total deductions, $1,727,892; balance, $2,881,021; miscellaneous receipts, $58,049; total profits, $2,939,070; total expenses, $1,759,413; net profits, $1,179,413; previous surplus, $2,451,228; total surplus, $3,630,641; dividends, $2,100,000; final surplus, $1,530,641.

For a consideration of $40,000, the Little Beaver Mining Co. has purchased the Marguerite and other mining claims of the Vicksburg Gold & Copper M. Co., all situated in Beaver valley. The mine and mill of the Newhouse Mines & Smelters Corporation are using electric power generated from the Beaver plant of the Telluride Power Co., near Beaver City. The Scranton Mining Co., operating in Tintic, will shortly resume ore shipments, which were suspended about the first of the year.

The mill of the Columbus Con. M. Co. at Alta has been started again, operating one shift per day. The railroad owned by the Rio Grande Western, between Sandy and Wasatch, covering a distance of about 18 miles, has been leased to J. E. Jacobs, former manager of the Salt Lake & Mercur railway, who proposes to supply better transportation for the mines of Alta. The road has been out of commission for several years, and the track will have to be practically re-laid the entire distance.

TORONTO, CANADA.

Provincial Government's Mine at Cobalt.—Corrupt Practices.—Official Juggling With Mine Titles.—Dismissal of Geological Survey Editor on Erroneous Charge.

The relations of the Provincial Government of Ontario to the mining industry have been a good deal discussed lately, in connection with several matters that have come before the Legislature. The policy of the Government as regards the Provincial, or as it is generally known, the Gillies Limit mine, at Cobalt, owned and operated as a public work, has been attacked. The Government has given out very little information as to the condition and prospects of the enterprise. It is claimed that as the investing public is deeply interested in Cobalt, the fullest information should be afforded as to the value of the property, the character of the ore at different levels, and upon anything which may throw light on the general question of the permanency of Cobalt veins. About all, however, that the Department is willing to give out is data concerning the extent of the workings and the amount of ore taken out. Frank Cochrane, when pressed for further details, stated that the mine was being worked as a business enterprise, and he did not propose to furnish data which might be used to boom wildcat schemes. The estimated revenue for the current year from this mine is $100,000. Another and much more important matter which promises to be an issue in the next election contest, is the apparently interminable Cobalt lake question, a new phase of which has cropped up. The whole business throws a strong light on the subject of how mining titles are mixed up with political trickery, which may partly explain the shyness of American investors with regard to Ontario propositions. It will be remembered that the title to the bed of Cobalt lake was claimed on the ground of original discovery by the Florence Mining Co., but the claim was not recognized by the Government, on the ground that at the time of the alleged discovery the lake had been withdrawn from prospecting. The Government sold the lake to the Cobalt Lake Co. for $1,085,000, whereupon the Florence company brought action to maintain its claim. Before it came to trial the Government secured the passage of a special act validating the title of the Cobalt Lake Co. Application has been made to the Dominion Government to disallow that measure, and in the meantime legal proceedings are suspended. All this is an old story. Now comes another claimant, Harry Dreany, who asserts discovery prior to that of the Florence company, and states that his application to record the same in May, 1905, was refused, the reason assigned being that the Government had not decided on its policy regarding that territory. Dreany then came to Toronto, and gave a large interest in his claim to Frank B. Chapin and Charles

Lamarche, who asserted that by using their political influence with the Government they could have the claim recorded. Lamarche was a member of the Legislature. About that time Frank Cochrane was in search of a constituency. A deal was made; Lamarche resigned his seat, Frank Cochrane got it, and the mining recorder received official instructions to record Dreany's claim, which was done in July, 1905. Notwithstanding this, however, in the following month Cobalt lake was withdrawn from location and subsequently, as already mentioned, disposed of to the present holders, Lamarche receiving a snug office as compensation. These facts were developed in a damage suit brought by Dreany against his partners in the deal, and an attempt was made to have a full investigation before a committee of the Legislature, which, however, was avoided by the tactics of the supporters of the Government. The affair has been ventilated in the Legislature, however, and is likely to give the Government a good deal of trouble. The shareholders of the Cobalt Lake Co., whose stock has been steadily depreciating as a consequence of these continuous attacks on its title, has petitioned the Government for compensation. The title of the Temiskaming & Hudson Bay company is also assailed, the Government having brought action to recover royalty on the output on the ground of absence of valid right to the property. It is anticipated that a settlement will be effected. The transaction is not of a nature to encourage outsiders without a political pull to invest heavily in enterprises on the faith of an Ontario title, which may be subject to a 10 or 25% royalty hold-up as soon as it becomes productive.

F. J. Nicolas, editor of the reports and publications of the Canadian Geological Survey, has been dismissed on the unwarranted accusation of having written or inspired the criticism on J. W. W. Spencer's report on Niagara Falls which appeared in the MINING AND SCIENTIFIC PRESS. Samuel Graves, of the Mines Branch, has been appointed his successor. A. C. Boyce, of Algoma West, drew the attention of the Canadian Parliament to the subject.

BUTTE, MONTANA.

Amalgamated Co.'s Production.—Reduction of Cost.—Butte-Milwaukee Resuming.—Decision Adverse to Placer Ground Titles.—North Butte Extension.—Rumors of Consolidation.

The Amalgamated Copper Co. is not returning to normal conditions of mining and copper production as rapidly as had been promised at the time of resumption on the first of March. Not more than 3000 additional men have been put to work in the Butte district since March 1, making the total number employed at the properties of the Amalgamated subsidiary companies between 5000 and 5500. The number employed normally is about 8000. The Amalgamated companies are producing copper at the rate of 14,000,000 to 16,000,000 lb. per month, and it is not considered likely that the production will be very much increased for some time with copper prices declining. The fear is general in Butte that if the copper market does not improve within the next three months, another shut-down of the Butte mines will result. Still it is asserted by high officials in the Amalgamated company that the latter can produce copper as long and as cheaply as any other important concern can do so and make money. It is a fact, demonstrated since the resumption of mining, that the Amalgamated can produce copper much more cheaply than it did at any time during the past seven years, and that the present production is not costing over 10c. per lb., including refining and selling.

Orders have been received from New York by John Miles, superintendent for the Butte-Milwaukee Mining Co., to prepare for resumption of development work, and a foundation is being built to receive the new Nordberg hoisting engine, which has been shipped and will be in Butte by the time the foundation is ready to receive it. When the new machinery is installed sinking will be resumed on the Colonel Sellers shaft. The shaft is now down 700 ft., and it is the intention of the company to sink it to a depth of 1500 ft. before doing any exploration work. It is the opinion of mining engineers and operators familiar with that part of the Butte district that good commercial ore will be found in the veins at that depth. The Butte-Milwaukee group of claims is well situated in the part of the Butte district where the biggest strikes of ore have been made in recent years.

In another action similar to the one decided a week ago by Judge Hunt of the United States Court, involving a contest between quartz and placer claimants in South Butte, the Supreme Court of Montana has given a decision in favor of the quartz owner, thus going contrary to the decision of Judge Hunt. However, both decisions are based entirely on facts, and not on legal questions. In the Hunt decision it was held that the proof of the quartz claimants was not strong enough to support a judgment in their favor. In the State Supreme Court, in an action of W. A. Clark and others against J. A. Clifford, the Court holds that the evidence was sufficient to show that valuable quartz leads were known to exist at the time application was made for the placer patent. The entire southern portion of the Butte district is covered by placer patents, but it was well known to old-timers that copper veins existed before the placer patents were applied for. The recent decisions indicate that it is only a question of proof, and that if the locators of quartz claims can marshal sufficient evidence to satisfy courts and juries that quartz veins were known to exist before placer patents issued, the quartz titles will be upheld in spite of the placer patents that have existed for a quarter of a century and more. The Amalgamated Copper Co. owns a great deal of ground under both placer and quartz titles, as does the East Butte Co. The latter owns a large quartz location, known as the Oneida, under which it has not yet asserted rights beyond its placer ground. If it does so, and makes good its quartz title in the courts, its mineral rights will be immensely extended. Its title will be questioned for the first time in a small suit brought by the South Butte Mining Co. against some lessees working in East Butte ground, whom the East Butte company is protecting.

The North Butte Extension M. Co. has resumed sinking on its shaft, which was 525 ft. deep when work was stopped, while a large station was being cut on the 500-ft. level. The station has been completed, and a big pump is being installed. In the meantime sinking will be carried on in addition to other work. A 3-ft. seam of well mineralized material was cut in the station. The ground of the company, wherever opened, is found to be highly mineralized. Several veins and numerous seams have been cut in the shaft and stations. It is probable that some cross-cutting will be done at the 700-ft. level.

The mines of the Butte district are running and producing copper at about the same rate they did during the latter part of March, and it is the intention of the Amalgamated company to keep production down to a conservative volume. About 8000 tons of ore are being shipped daily to the Washoe smelter.

A persistent rumor is afloat that negotiations have been on for some time for the acquisition of the properties of W. A. Clark in the Butte district by the Amalgamated interests. The rumor has once been denied by Mr. Clark, but in the face of that some of his close business associates have acknowledged that there is some truth in the rumors. They point to the fact that some important business plans of Mr. Clark have been held up for months, something unknown heretofore in Mr. Clark's business matters, which is believed to be due to the pendency of negotiations for a transfer of all his business interests in Butte. Reports have it that his bank alone is exempt from the proposed deal. Several years ago Mr. Clark received a flat offer for his mining interests in Butte, but he declined because he considered the price at that time, when the copper boom was at its height, inadequate. Conditions have greatly changed since then, and friends of Mr. Clark say that he is not averse to retiring from the activities of mining, as he is getting well along in years.

COBALT, ONTARIO.

Increase in Shipments.—Milling Facilities.—New Discovery of Rich Ore.—Mining Under the Lake.

In the first quarter of 1908 the shipments of ore from Cobalt have amounted to 4332.48 tons. Five new shippers have made their appearance during this period, namely, the Casey, Cobalt Lake, Crown Reserve, Provincial, and Silver Cliff. These are expected to prove regular shippers; but as the Casey does not lie within the limits of the camp, predictions concerning it cannot be made. It lies about 12 miles distant. Twenty-five mines shipped ore during the first three months of 1908. These were: La Rose 751 tons, O'Brien, 714; Nipissing, 410; McKinley-Darragh, 379; Silver Queen, 240; Tretheway, 213; Buffalo, 205; Coniagas, 192; Temiskaming & Hudson Bay, 192; Kerr Lake (Jacobs), 135; Watts (of King Edward group), 121; Temiskaming, 119; City of Cobalt, 114; Cobalt Lake, 90; Nancy Helen, 71; Foster, 54; Drummond, 46; Cobalt-Central, 45; Town-Site, 43; Silver Leaf, 31; Right-of-Way, 30; Silver Cliff, 26; Provincial, 25; Casey, 20; Crown Reserve, 7; and a miscellaneous shipment sent for smelter experiments, 20 tons. In the corresponding quarter of 1907, nineteen mines shipped 2911.41 tons. The market for Cobalt ores is extending. The smelters at Denver, Colo., and at Trail, B. C., got the La Rose and City of Cobalt ores respectively, and the Nancy Helen shipped 40 tons to Trail the previous week. The Perth Amboy, Carnegie, and Chrome smelters each got a car, and the Cobalt Lake Co. shipped to Swansea, Wales. The Kerr Lake Co. or Jacobs has signed a contract for 100 tons with a German smelter in Hamburg, and sent its first carload last week. Then a third Canadian smelter is in operation and received its first car from the Coniagas mine last week. This smelter is situated at Thorold, in Welland county, only a few miles from Niagara Falls. The shipment last week was the first trial of a car lot, and consisted of high-grade ore and concentrates. The Coniagas was one of the first mines to install a concentrating plant. Superintendent Reddington has his mill in operation and treats 50 tons of ore daily, 1500 lb. of concentrate being the resultant product. This mine will hereafter ship but two carloads per month, or about 1¼ carloads of high-grade ore and ¾ carload of concentrate. The Cobalt-Central mine, known as the 'Big Pete,' also ships only high-grade ore and concentrates, and the Buffalo and McKinley will no longer ship their low-grade ores. Two custom concentrators will be in operation within a couple of months. The net result will be the absence of shipments from Cobalt of ore carrying less than 500 oz. silver per ton.

The sensational discovery of a rich ore-shoot on the shore of Kerr lake on an extension of the Silver Leaf vein has revealed as rich a vein as any found in the camp. The Crown Reserve paid the Ontario Government over $175,000 for the right to mine 22 acres under Kerr lake. In addition to the purchase price, the Government receives a royalty of 10% on the ore mined. The Silver Leaf is one of the properties bordering on the lake, and this company made a rich find last fall near the lake. An open-cut was started about 21 ft. square. There was vein matter throughout the entire width, and solid metal from 4 to 7 in. wide was found. There were also innumerable calcite stringers carrying silver in varying quantities. This open-cut is now a shaft nearly 110 ft. deep, and at a depth of 100 ft. the vein is 14 in. wide, consisting of a mass of calcite and silver. The richest part of the ore-shoot has a length of 7 ft. Recently a piece of vein-matter was broken which weighed 20 lb. and was practically solid silver. A drift has been started in the Leaf shaft, at a depth of 80 ft., under rich ore. A few feet distant, just across the boundary line, the Crown Reserve started an open-cut. This is now 40 ft. deep, 25 ft. long, and 8 ft. wide. At the bottom of the cut the vein is 28 in. wide, composed entirely of calcite and silver. A piece of the vein-matter was hoisted the other day weighing 1200 lb., that yielded at the rate of 10,000 oz. silver per ton. The Crown Reserve shipped 6.85 tons of ore by express to the Perth Amboy smelter, that the superintendent, Sam Cohen, affirms will net the company over $35,000. A 20-ton car of this high-grade ore will be shipped next week. The ore has to be cut up with chisels, being so rich in silver.

John MacDonald, superintendent at the Foster mine, has been pushing development work and will resume shipments this month. The main shaft is down 225 ft., and a station is now being cut preparatory to driving the third level at a depth of 210 ft. Sixty men are employed in this mine, with six drills, running double shift. The Cobalt Lake mine is now a regular shipper. Two shifts are maintained at work, 65 men being employed. Shaft No. 4 is sunk on the shore line near the Nipissing tunnel. The first level is at a depth of 86 ft., and the second level at a depth of 150 ft. From the first level a drift was run on a calcite vein extending under the lake, and some stoping was done. This vein averages 200 oz. silver per ton. Ninety-three feet of cross-cutting was done toward the north, at which point the big niccolite vein (No. 3) was tapped. This vein has a width of 28 in. and is rich in cobalt. The cross-cut from the shaft has been extended beyond No. 3 vein 190 ft. and will be continued under the east shore of the lake to tap all the veins on that side. There is also a cross-cut from the drift extended from shaft No. 4, connecting shafts 4 and 5. This cross-cut continues past shaft No. 5 in a southerly direction 215 ft. At the 150-ft. level a drift has been run from shaft No. 4 110 ft., which will be continued across the lake. Shaft No. 6, near the McKinley-Darragh, is now down 135 ft. Driving on the first level will be started this week. Fifty feet of rock will be left between the drifts and the bed of the lake to ensure safety. E. L. Fraleck, the superintendent, has encountered no difficulties in mining under the lake which could not be successfully overcome.

At the Right-of-Way the superintendent, Joe Houston, has eight men and six drills working on double shift. Shafts No. 1 and 2, which are 520 ft. apart, were connected by a drift on the 86-ft. level.

Concentrates.

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

In electrolytic refining, the anodes cast from blister copper are dissolved and the pure metal deposited on the cathode, the precious metals being left as an insoluble slime.

Fine grinding cannot be economically accomplished in stamp-mills, and even when a large proportion of the pulp is highly comminuted, the product will show a wide variation in size. The expenditure of power increases rapidly with the degree of fineness attained. To accomplish fine crushing in a stamp-battery it is necessary to use a deep mortar, to increase the height of drop of the stamps, and to decrease the speed.

In experiments made on the smelting of iron ore by electricity, the amount of carbon used has generally been too high to get the best efficiency, theoretically. A smaller proportion of carbon, more perfectly consumed to CO_2, would generate more heat, and thus help the furnace. In most of the work the electric current furnished about two-thirds of the energy required for all purposes and the carbon one-third. Gas analyses are of the utmost importance in regulating the efficient working of the furnace.

Hard amalgam can be removed from old copper plates by covering the plate with a wooden frame, well packed with blankets or burlaps, so arranged as to leave a space of several inches between the plate and the frame. Into this space turn dry steam at as high a pressure as possible. After steaming for several hours, remove the frame, and if feasible chill with cold water. The hardened amalgam will, to a considerable extent, become detached in flakes, or may be readily removed with scrapers. In the hands of careful workmen the amalgam may be removed completely with chisels or scrapers after steaming, without injury to the surface of the copper plate.

The cost of mining narrow veins depends upon the method used. In the case of a mine in Rhodesia two systems were tried, that of mining the quartz and adjoining rock together, and later resuing was applied, that is, stripping the vein first on the foot-wall to a depth of 30 in. This waste rock was largely used as filling, although a certain percentage was necessarily sent to the surface. When about 3600 sq. ft. of quartz had been stripped, this was broken down as a clean product, so that no sorting was required. In both cases the gold occurred in a 6-in. streak of quartz assaying about 50 dwt. per ton. Of this, 75% was recovered, that is, $36 per ton. In the former case the cost of mining and milling 100 tons was $772, representing a loss on the operations, while by adopting the stripping method, a good profit was obtained. In another case, a 12-in. vein assaying $28.80 per ton was mined by a similar method, and a marked reduction of costs effected.

Preservation of timber against decay is effected by impregnation with various substances, among which are blue vitriol (blue-stone or copper sulphate), corrosive sublimate (mercurie chloride), zinc chloride, and chiefly creosote oil derived from the distillation of coal in gas-making and in by-product coking. The creosote oil is contained in the tar condensed from the hot gases leaving the retort. It is separated from the tar by distillation between the temperatures 400 and 700°F. The European output of creosote oil is obtained by distillation at a slightly higher temperature, the resultant oil being less soluble in water and less subject to evaporation in the air. On these accounts it is superior as a wood-preservative. The United States Government is advocating the production in this country of creosote oil of better grade for preservation of timber, as an additional means for protection of the rapidly disappearing forests, by lessening the consumption. Bulletins on this subject may be obtained gratis from the Forest Service of the Department of Agriculture at Washington.

In a case where 'A' owns two adjoining claims, and in December, 1906, performed $100 worth of work, and in January, 1907, another $100 worth, the work being performed on but one claim, though benefiting both; and again in December, 1907, 'A' performed $50 worth of work, and in January, 1908, another like amount on the same claim; after which 'B' jumped both claims: whose claim is valid?

'A' may plausibly claim the $100 worth of work done in January, 1907, the $50 in December, 1907, and the $50 in January, 1908, aggregating $200, as work done for the year 1907 for the benefit of the two claims. In other words, in 1907 he expended $150 and in January, 1908, before any adverse re-location was made, he resumed work and made up the deficiency, that is, $50. A subsequent locator would not, we think, have any standing in court which would permit him to go back of January, 1907, and show a pending delinquency for 1906, as at that time the re-locator had no interest in the claim. The subsequent re-location could not by operation of law relate back to 1907, so as to permit an inquiry into the status of the claim at that time. A's defense against a re-location made after January, 1908, would be complete as showing the $150 expenditure at any time in 1907, and the $50 in January, prior to a re-location. This view, if it is correct, enables owners of claims to overlap the assessment work and to a degree hold claims without really performing the full amount of work each year. But the performance of assessment work is not a matter with which the Government is concerned. Failure to perform it can only be taken advantage of by a hostile re-locator, and the facts and conditions as they exist at the time of the re-location are the only ones which are the proper subjects of inquiry. While 'A' has in a measure evaded the law, the subsequent re-locator is not in a position to complain. While the solution offered is involved in some doubt, we incline to the view that the re-locations are invalid and A's title will prevail against them.

Discussion.

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy.

Smelting Zinc Electrically.

The Editor:

Sir—In your issue of March 7, under the heading 'Concentrates,' you say: "Zinc smelting by electricity is now being carried on successfully in Europe and British Columbia." Mine operators in the Slocan, B. C., are vitally interested in a successful electric process for the reduction of zinc and lead ores, and would greatly appreciate a full description of the European process mentioned in your columns. Your statement as regards British Columbia is a little misleading. A small experimental electric plant was started at Vancouver two or three years ago and was reported a success. The same company began the erection of a smelter of commercial size at Nelson last year, but owing to lack of funds the plant has not been completed. In the *Transactions* of the Tristate Mining Association (and in your issue of December 7, 1907), Frederick T. Snyder describes this process and says a complete separation of both zinc and lead was made at a greatly reduced cost over that of the ordinary retort type of furnace. The commercial success of such a process means much, not only to the Slocan mine but to other properties all over British Columbia and the Coeur d'Alene in Idaho as well.

The orebodies of this immediate neighborhood are veins of argentiferous galena and sphalerite, with some tetrahedrite, chalcopyrite, and pyrite, in a gangue of quartz, calcite, and some siderite. They cut through limestone, shale, and slate, and occasionally granite, diorite, and diabase are encountered. Near the surface galena predominates, but at depth nearly every mine in the district becomes 'zinky' and work is then abandoned. This is well illustrated in the Standard mine, situated at an altitude of 1700 ft. above Lake Slocan. The old stopes in the upper levels show some zinc-blende, but the ore shipped was a high-grade clean galena. In the present workings, between tunnels No. 3 and 4, the ore is a clean argentiferous galena, the shipping ore running 65% lead, and very little of it reaches the 'zinc penalty limit' of 8%, above which point the Trail smelter penalizes zinc at the rate of 10c. per unit. Tunnels No. 5 and 6 have not as yet encountered the main ore-shoot, but the Emily Edith mine, adjoining, and at a much lower horizon on the same vein (800 ft. above the lake), has but little lead and large bodies of zinc ore. A sample in the main orebody, for example, shows: 24.6% Zn, 10% Pb, 10.3 oz. Ag. The commission appointed to report on the zinc resources of British Columbia advise a very complicated and costly process for treating such an ore, involving as it does water concentration, roasting, magnetic separation, and finally the smelting of the separate products.

The Emily Edith Mines Co. Ltd., an English corporation, failed to make their mine pay, and after doing a lot of prospecting in an endeavor to find clean galena, ceased operations and leased the property. The lessees shipped several carloads of zinc concentrate to the zinc smelter at Frank, Alberta, but when that plant shut down everything came to a standstill. The Sullivan mine and smelter at Marysville, B. C., closed down, it is said finally, about the first of March for much the same reason, namely, ore getting too zinky. Everyone damns zinc, whereas it should be a valuable asset.

There are several promising looking prospects on Pine creek, near Wardner, Idaho, in which the ore is a compound of galena and sphalerite so intimately associated that extremely fine grinding would be necessary before a separation could be made either by a water or magnetic concentrator. This would produce so much slime and involve such a high loss in the tailing that separation is altogether impracticable. The only solution appears to be: Separate out the gangue by means of jigs, tables, vanners, etc., and smelt the mixed concentrate of lead, zinc, and iron together, separating the lead from the zinc by liquation in the furnace.

An electric smelter that could do this would indeed be a blessing, especially as we have almost unlimited water-power in the Northwest, wherewith to make the wheels of a generator go round.

J. V. RICHARDS.

New Denver, B. C., March 15.

Producer-Gas Power.

The Editor:

Sir—Mining involves the moving of masses; and for this, power is requisite. It is an odd phase of our slow and tardy grasp of evolution that power or energy is the one common object of strife in this comedy-tragedy called natural selection. New houses, new clothes, food, fuel, money, new materials, all represent only so many kinds of matter in a high state of energy; and old clothes, old houses, ashes, waste, and debts represent matter in their low state of energy.

These truisms are as stupid as they are melancholy, unless someone has some remedy to suggest; and I can imagine some tired superintendent at night looking critically over this column to see if it offers him any help in his unequal struggle with ore-getting and ore-dressing. It is almost an axiom that nowhere can a manufacturer make more money with less lost-motion than by saving on the power end; and if any reduction of fixed power-charge can be made anywhere it ought to be made in legitimate mining. The proposition that I wish to emphasize refers to the use of the gas-producer as a source of power for the mine as well as for the mill: and the miner whom I have particularly in mind is he of the intermediate grade who has outgrown the mule power and who must have a small engine, this year 10 or 20 horse-power, next year 30 or 40 hp., and so on. For such business conditions the use of producer-gas power is a proposition to be considered. Probably most of the readers of the MINING AND SCIENTIFIC PRESS are familiar, in a general way, with this subject, but it is not probable that many can have taken time to study the gas-producer and the

gas-engine thoroughly as applied to their own needs. This is the more strange because the miner is usually a progressive man, progressive both by instinct and by necessity. The condition could be explained more easily if it were in New England, where I have been working for nearly a year to introduce a good gas-producer and gas-engine and where after a year's hard work they are only beginning to 'sit up and take notice.' Probably the first objection that will be raised against the gas-producer is the question of reliability, and on this point I wish to go on record: that, while there are producers and produeers, and gas-engines and gas-engines, yet, with a good gas-producer and a good gas-engine adapted to each other, a gas-power plant may be fully as reliable as a steam-power plant of the same size, provided that the gas-producer and gas-engine be made of good material, and provided that the operator is as familiar with the theory and practice of the produeer and gas-engine as he is with that of the steam-engine. Thus it is foolish to construct a gas-produeer of east-iron; and it is foolish to design a gas-engine of the vertical type with over-hanging valves: and it is foolish to put either or both of these in charge of a man who will not give them a little intelligent sympathetic attention. It is probable that most of the misunderstandings and misrepresentations that have occurred could be explained by attention to these points. Further, a complete produeer-gas power-plant costs more than a steam-plant of the same size; this is true up to 400 or 500 hp., but the saving in fuel will usually pay for the difference in 5 or 10 years, and sometimes in 3 to 5 years. And regarding the nature of the fuel—this is a large subject. Few parts of the country can depend on anthracite, the practice of which with produeers is more nearly perfect than for any other type of fuel, unless it be coke or charcoal. Bituminous coal and lignite produeers are a little more costly to build, and a little more expensive in attendance; moreover it is still an open question, whether the best practice will scrub out the tar or will burn it out.

In the East the use of peat is too far removed from commercial practicability to be regarded seriously, though peat is quite likely to figure more prominently in five or ten years; but there are other fuels, such as the ubiquitous sage-brush, which has been suggested as a produeer fuel, and which Mr. Edgar Rickard of the PRESS assured me that he had used most successfully, in lack of other available fuel, under the boiler. Of course we all know of the reports on the use of produeers at mines the world over, and some of these reports are favorable and some are unfavorable. But it is safe to say that the progressive mine superintendent should lose no time in getting acquainted with the main principles of the produeer; and if he happens to be surrounded by an abundance of available material, like sage-brush, but which is not supposed to be suitable for the produeer, there is no law of Nature which can prevent him from finding out a thing or two for himself. In remote mining camps, with good ore but no water-power, where coal or oil become too costly after distant transportation, and where gasoline is frequently used even at extravagant cost, in such places there is a chance for the enterprising engineer to do a little experimenting with fuels for the produeer. Meanwhile it remains true that all plants using power on costly coal should certainly investigate produeer gas. I shall hope, sir, to continue this subject in later communications.

CHAS. S. PALMER.

Boston, March 21.

Slime-Filters.

The Editor:

Sir—Reading Mr. Arthur DeW. Foote's nutritious article in your issue of February 1, impels me to pick out the subject of slime-filters and the associated patent litigation, over which we have been holding our breath, and suggest a point that seems not far from the surface. As I am installing one of the processes mentioned, it has a practical value to me.

It may be better business, as Mr. Foote suggests, for the slime-filter process owner to speak gently and with soft words coax the frightened miner to use his process, but it seems better business to get the mining world talking of the various processes; and how can free advertising be better obtained than by a fight, on paper. An American loves a fight, and many a busy man has stopped his rush through the street to see whether the under or upper dog won. Although a prospective user of one style of filter, I am burning the best obtainable grade of the best advertised oil to learn how much better and how much cheaper I could have filtered my slime if I had bought So & So's filter. I think the black-typed advertisements eminently proper and suitable from the point of view of the advertiser. I have not read any of the patents. I never did finish reading all the patents for the cyanide process.

Let me congratulate you on the new dress for your editorial and reading columns. Busy men read at night, and fine print is trying.

C. Y. K.

Pasadena, April 2.

Rock Penetration by Air.

The Editor:

Sir—Some years ago I had occasion to do some development work on a property where the air-compressor was run by water-power, and during the low-water season there was not sufficient power to furnish air for one drill. The vein, a very irregular one, was in quartzite, close to a syenite and quartzite contact, and in places irregular wedges of this syenite penetrated the quartzite and would cut off the vein, which would be found again on the other side of these intrusive wedges of syenite. At one point, to determine whether or not it was a persistant contact or only a wedge, a drift was run into the solid syenite foot-wall for a distance of about 150 ft. This was at a point some 1300 ft. from the mouth of the adit, and some 600 ft. from the surface, measured vertically, and this drift for the entire distance appeared to be without a fracture in the rock and, in fact, appeared as one solid block of granite.

Under the conditions as stated, I thought it would be practical to place a concrete dam about 50 ft.

back from the tunnel in the drift and then use the remaining 100 ft. of the drift for a receiver in which to store compressed air. The sides, top, and bottom of the drift were carefully trimmed, to remove all loose rock, and a concrete dam was built in the drift; in this dam a large pipe was inserted, both for a man-hole and for pipe connections; after the concrete had set the compressed air was diverted to the supposed receiver; though the dam was well rammed yet the air leaked through it very rapidly. We then turned off the air, removed the man-hole, and placed a coat of neat cement on the inside of the dam, and for 5 ft. back on the top, bottom, and sides of the drift; after this set we again turned in the compressed air, and, as far as could be determined, not a particle of air leaked through the dam. We could readily raise the air-pressure in this rock receiver to a gauge-pressure of about 45 lb., above which point it would increase very slowly. With the small plant it was impossible to obtain a gauge-pressure of 50 pounds.

Upon the closing of the intake valve the pressure would gradually decrease, and in about 36 hours time the gauge would again register at zero.

J. P. K.

Wallace, Idaho, March 23.

Misleading Assay Statements.

The Editor:

Sir—The so-called Vidler tunnel was incorporated about seven years ago, and was planned to connect the Argentine district, on the east slope of the main range, with the Horseshoe on the west; it will have a probable length of 7000 ft., of which practically 3000 is driven on the east side and 2000 on the west. It was intended to intersect the numerous known veins of these two districts and ultimately to be enlarged so that it could be used for transportation purposes. While tunnel schemes as such have heretofore uniformly proved failures, we are all looking forward with interest to the time when this statement will be disproved and a successful tunnel for general mine exploitation be made. My object in writing is not to offer criticism of the project, but to call attention to the means whereby the promoter was enabled to raise funds for the work. Several veins were cut and drifts upon them showed that they had some ore; it was found necessary to have some outside opinion on the scheme and on the value of the ores found. To render this opinion, a newspaper man was employed; he is a man equally well equipped to write a census report, an irrigation report, or to inform the ignorant of the value of the sugar beet; his opinion of a mine is apt to be of as much value to an investing public as his opinion of a sugar-mill, and no more. It is stated that he took four general samples, which yielded the following returns by assay:

"Stope, north drift—Gold, trace; silver, 3.80 oz. per ton; lead, 15.45%; copper, trace; zinc, 4.93%; value per ton, $19.68.

"Stope, north drift—Gold, trace; silver, 7.40 oz. per ton; lead, 58.65%; zinc, 11.82%; value per ton, $63.40.

"Breast, west fork, south drift—Gold, trace; silver, 1.88 oz. per ton; lead, 4.63%; zinc, 28.07%; value per ton, $32.95.

"Breast, east fork, south drift—Gold, trace; silver, 1.12 oz. per ton; lead, 1.40%; zinc, 16.35%; value per ton, $18.18."

Sample 1.

Smelter pays 95% N. Y. quotation on the silver.
Assume: Silver @ 60c. per oz.
Lead @ $6 per 100 lb.
Zinc @ $6 per 100 lb.

Value of silver		$2.16
" " lead, 15.45%		8.80
		$10.96
On neutral basis:		
Smelting charge	$4.00	
Freight	2.50	6.50
Balance for mining and profit		$4.46

Sample 2.

Silver		$4.22
Lead, 74c. per unit for 58.65%		43.10
		47.32
Zinc penalty	$0.91	
Treatment	1.00	1.91
		$45.41

Sample 3.

Silver	1.88 oz.	Worth nil.
Lead	4.63%	No payment by smelter.
Zinc	28.00%	Not a shipping zinc ore.

If it is milled, not over 50% can be saved, that is, 14% Zn. Smelters pay $22.50 at Pueblo for a 45% Zn, at 3 tons into 1. The ore may be assumed to be worth $7.50 per ton, from which freight to Pueblo is to be deducted, say $2.50, or $5 net.

Sample 4.

Silver	1.12 oz.	Worthless
Lead	1.4%	
Zinc	16.3%	

The values given in the report as representing the various metals is so wholly misleading as to closely approximate the criminal: they are based upon the current market quotations for the metals and assume that the assay-contents will be paid for; in case the ore is shipped to a smelter there will be the various deductions, penalties, and smelting charges; in case the ore is milled, there is a loss in treatment. These are disregarded. If this work had been entrusted to a competent engineer, it is safe to assume that the bare figures submitted would be discussed as to charges or losses, so that an intelligent idea of the result to the operators would have been given. The man that submitted the report was either ignorant or suborned, in either case being wholly unfit to write a mining report. This brings up the question, should an assayer undertake to give the coin value of the metals contained in a sample without some reference being made to the inevitable deductions or losses that attach themselves to such ores? This is only one of many such instances occurring under my observation, and it is a blunder that hurts the dear confiding public. It has all the ear-marks of a confidence game wherein the respectability of the assayer is traded upon.

We cannot stop incompetents from writing reports, but can we not get the assayers of this country to adopt some form of returns that will warn the unwary and prevent the issuance of such misleading statements?

ENGINEER.

Boston, March 20.

A TERTIARY RIVER CHANNEL NEAR CARSON CITY, NEVADA.

Written for the MINING AND SCIENTIFIC PRESS
By JOHN A. REID.

The geologic history of the Sierra Nevada must be interpreted largely through a knowledge of the Tertiary rivers whose channels are so well preserved upon the western slope of the range. These ancient channels are economically important for their store of gold, which has added many million dollars to the world's treasure. There is thus a

Buried Gravel Exposed by Faulting.

double interest in the old rivers of the Sierra, that of the scientist and that of the miner, and the latter individual must not forget that his highest interests are best served by pushing scientific inquiries to the farthest point possible, for science is the partner of industrial art.

At the present time our knowledge of these Tertiary rivers is confined to those on the west slope of the range. From the discovery of gold in California, through the first wonderful days of mining, down to the vicissitudes of recent times, the miner and geologist alike have investigated the channels of the old westerly flowing rivers, until our knowledge of them is fairly complete. Nothing, however, has been noted concerning Tertiary rivers east of the summit of the Sierra. There is a large and well defined channel on the east slope that needs description, both for purely scientific and commercial reasons. The details of the geologic bearing of this old river upon the history of the region will be presented as part of a larger paper now in preparation; it seems advisable at this time and in this place to present such facts about the channel as appertain to the mining industry.

This Tertiary river is found between the northeast corner of lake Tahoe and Washoe lake, and lies about six miles northeast of Carson City, Nevada. It crosses the east summit of the Sierra Nevada, there being two crests in the east-west section of the range through lake Tahoe. No traces have been found west of the lake, but scattered gravels on the hills of the Virginia range, east of Washoe valley, indicate its original extension farther in that direction. One of the old stories commonly heard at Virginia City concerns the finding of gold different in character to that of the Comstock in gravels underlying American Flat, west of Gold Hill. The portion of the channel preserved is remarkable in that, unlike the well known ones of the same age to the west, it traverses a region intensely broken and faulted, the great fault-zone of the Sierra Nevada. Precipitous scarps and gently rounded or flat summits characterize the topography. The latter in part represent the old eroded surface of the region at the time when it was drained by the ancient river and its tributaries. The topography is also characterized by a large well formed longitudinal valley, called Little valley. A second similar but much smaller valley lies east of the larger about two miles, and two other smaller ones are found still farther east. Each follows the plane of a north-south fault and separates two adjacent portions of the old river. The larger valleys are flat-bottomed, though less than half a mile wide. With their groves of tamarack pine along the floors, and their steeply rising walls, once well timbered but now only partly covered with low shrubs, they give a park-like aspect to the landscape.

The rocks of this area are few in number. The well known grano-diorite of the Sierra Nevada forms the only bedrock, the gravel resting directly upon it. A small residual spot of older schist, into which the grano-diorite is intrusive, occurs a few hundred feet south of the channel in the eastern part near Washoe valley. There are two rocks of later age than the gravel, both of volcanic origin. These, in order of relative age, are rhyolite and andesite. The rhyolite is white when fresh, weathering to pink. Frequently it is a breccia in its lower portions, and massive,

Buried Gravel Outcrops, Little Valley, Nevada.

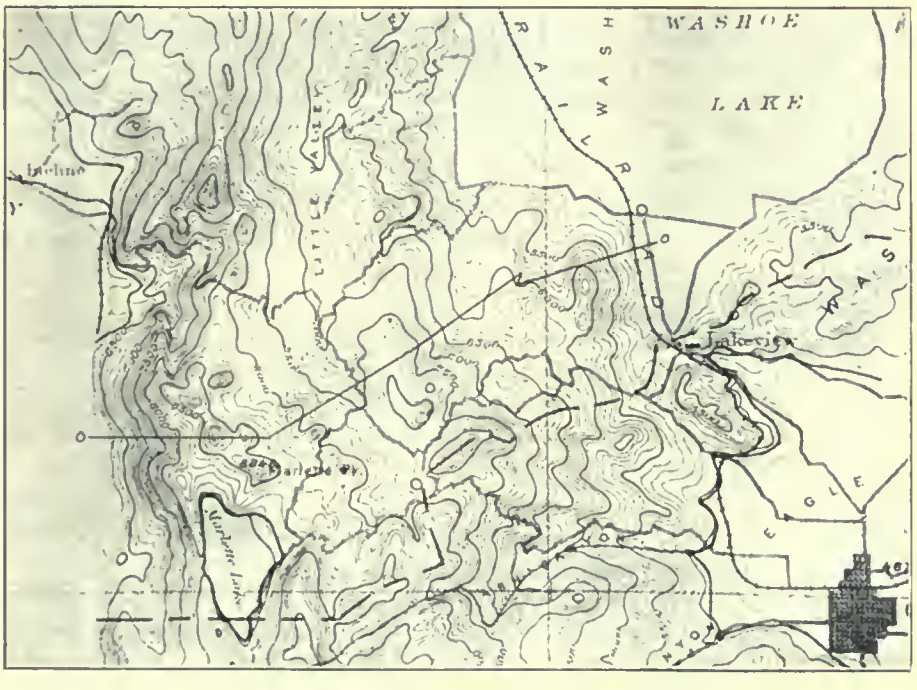
often slightly vesicular, above. It rests directly upon the gravel over a large part of its length, as shown in the section. In the main this cap is not thick. Connected with the acid lava are certain small occurrences of pitchstone, one of which, as a dike, is found just north of the gravel south of Washoe valley. The other volcanic is a hornblende andesite, of steel-gray to black color. This rock occurs in small isolated areas near the old river. In only one of these spots does the andesite actually overlie the gravel, and there but to a small extent. East of lake Tahoe the two volcanics have not been found in jux-

taposition; west of the lake the rhyolite underlies the andesite, as is also the case to the north in the Virginia range near Reno.

The section across the range through the river-channel affords a striking example of geologic structure. There exist seven distinct fault-blocks, each

Tamarack Flats, Little Valley, Nevada.

of which bears a remnant of the river-bed on its crest. The westernmost occurrence of the waterworn material is found at an elevation of 7900 ft. in a small exposure under the edge of the rhyolite area north of Marlett lake, on the upper part of the magnificent fault-scarp that here rises directly from lake Tahoe. No other traces of the river are found on this west fault-block. The length is presumably between half and three-quarters of a mile. Abutting against the



Topographic Map Showing Ancient River Channel.

east edge of the first rhyolite cap is a large outcrop of the gravel on the second section of the channel. Here the highest point is reached by the river deposit, 8700 ft. From this place to the bottom of Little valley, upon the summits of the two fault-blocks, the gravel persists in an irregular manner. The actual width of the channel is masked by rock disintegration and the action of recent forces of erosion and deposition. From surface indications this dimension is large, reaching a quarter of a mile or more at Little valley. At the summit the width is roughly 300 yards. The old river-bed has been tilted to the east in the second and third block; the condition of the first is unknown. In Little valley the gravel lies between the contours of 7200 and 7500 ft., the upper portion only being shown; therefore the

Little Valley, Nevada, Looking South.

bottom of the channel west of the creek in Little valley is probably several hundred feet below the bed of the creek. The length on the second and third blocks is about two miles. The fourth block, with its load, lies between the third and the second largest longitudinal valley.

The finest exposure is found on the east wall of Little valley, where some idea of the size of the ancient river can be gained. The north-south fault through the largest valley has caused the up-throw of the east block, thereby making an incomplete vertical cross-section of the watercourse. The best portion of the exposure shows the gravel resting upon the north side of the bed, which dips to the south. The photograph shows this feature. The gravel rises steeply above the floor of Little valley toward the flat crest of the ridge. The thickness is at least 500 ft., with the bottom not exposed. It may be suggested that part of this thickness is due to faulting, but the rhyolite, which caps the ridge and in part the gravel, fails to confirm this idea. The width here is 300 or 400 yards, giving a large volume of deposit. On this fourth block to the east the lava covers the channel, and a comparatively small outcrop appears near the top of the steep scarp. The elevation of the bottom of the channel on the west side is approximately 7100 ft.; on the east side the elevation is 7500 ft. This indicates a tilting to the west. Further, although full details are yet to be deciphered, the posi-

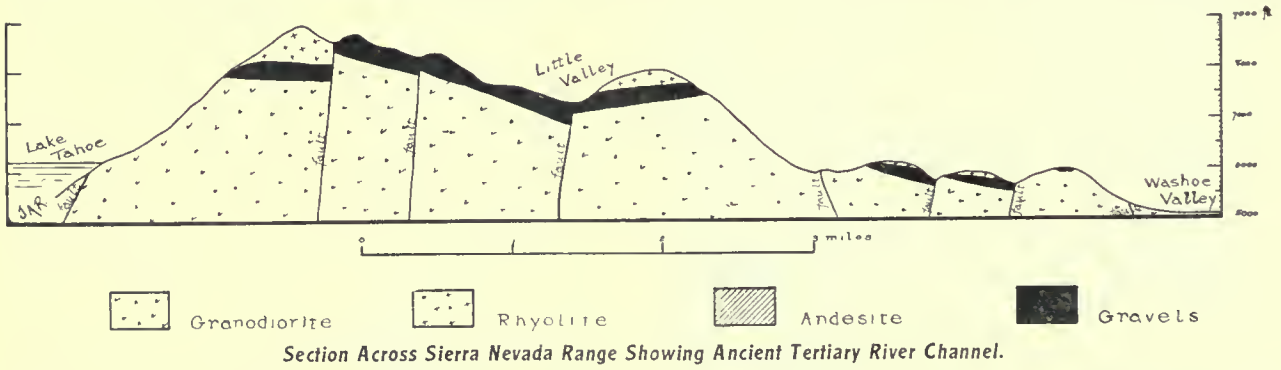
tion of the rhyolite upon the gravel may possibly indicate some tilting before the volcanic flow. The channel on this block has a length of nearly a mile. Across the second longitudinal valley a large part of the old river is missing, the gravel being found scattered in the present streams to the northward. The next two blocks are closely associated, at low elevation, and are largely lava-capped. The fifth fault-block carries only traces of waterworn material on the west side, but a deep deposit on the east, in one of the smaller longitudinal valleys. The elevation on the west is 5900 ft., on the east 5750 ft., with bottom not in evidence. The thickness at the latter place is about 300 ft. The width is uncertain, but is only a few hundred feet at most. This small dimension is almost certainly due to east-west faulting parallel to the channel, as both gravels and rhyolite capping cease suddenly to the south. Here again are details carefully to be worked out, particularly after more mining exploration has opened the ground beneath the surface. The length of this fragment is about half a mile, tilted to the east. The sixth block is also tilted eastward, the elevations of the gravels on the west and east respectively being 6000 ft. and 5700 ft. A horizontal element of the north-south fault that separates the fifth and sixth blocks has caused the latter portion to shift a few hundred yards to the south. A complex of small faults at this point renders further investigation necessary. No dimensions except the length of about three-eighths of a mile are obtainable, for the deposit is to be seen only along the south edge, where it lies beneath the thin rhyolite cap. The latter is in part a breccia. The seventh, or last, portion of the river channel occurs on the large symmetrical hill just west of the south arm of Washoe valley. The fault-block that forms this hill has been elevated relatively to those adjacent, with the result that the gravel upon it is found at a height of 6000 ft. and over. A small amount only is present, and no well preserved section of the river-bottom. On the east of Washoe valley the scattered boulders and pebbles were found at an elevation of 5500 ft. A rather large deposit of the same is found northeast of Carson, at a place where a small wet-weather stream debouches upon the floor of Eagle valley. This occurrence is undoubtedly due to the erosion of the original river-bed and re-deposition at a lower spot.

The gravel consists of well rounded pebbles and boulders of the bedrock complex of the Sierra Nevada, and includes quartzite, meta-andesite, schist, grano-diorite, and some pebbles of a more basic crystalline rock—probably a gabbro. Decomposition prevented the precise determination of the last rock mentioned. In the gravel of the fifth block, at the exposure shown in the photograph, a large number of boulders of iron ore occur. This ore is hematite in lustrous black plates, accompanied by some magnetite. It is associated with quartz and metamorphic rocks. In size the gravels range from 6 and 8 in. boulders down to small pebbles less than one inch. The coarser material appears to occur toward the bottom of the channel.

The exact position of the gold cannot yet be ascertained It seems to be well distributed on the surface and wherever mining has been done. The size of the well-rounded grains varies from that of mustard seeds to that of coarse nuggets.

Prospecting Buried River Gravels.

A question of interest, both to the geologist and miner, is the flow of this Tertiary river. Exposures being so few and poor, and no fresh contact of gravel on bedrock being yet brought to light, direct evidence, on the other hand, all indicates an eastward movement of the current. The gravels are composed of rocks exactly similar to those found to the west, and not to the east within reasonable distance. The quality of the gold is Californian, rather than that of the Great Basin deposits. The summit region of the Sierra, now chiefly granitic in character, was once covered with a great thickness of altered rocks, just as are the lower westward slopes today. In these altered rocks it is probable that gold-bearing quartz veins were present. The metal from these was carried away by the ancient streams and depos-



Section Across Sierra Nevada Range Showing Ancient Tertiary River Channel.

ited in favorable sites in their beds. The gold in this particular river is probably of such an origin. Furthermore, if the river were a westward flowing stream, it seems difficult to account for the entire absence of a large channel west of lake Tahoe in line with the one east of the lake.

The mining done has been of the rudest sort, and at only a few places. In Little valley, in the third portion, a tunnel has been driven southerly into the deposit. The value of the gravel struck is not known. In the early days near the same place shallow cuts disclosed a pocket beneath a portion of the gravel, from which it is reported $60,000 was recovered. The more recent work in Little valley has made evident the presence of much east-west faulting parallel to and through the channel. The same faulting is one of the larger characteristics of the fault-zone. In the immediate area under discussion the general effect has been to raise the country to the south, thus dropping the north edge of the river deposit. In the east side of the river portion there

Scene in Little Valley, Nevada.

has been a little work. A shaft and an incline have been sunk, but a super-abundance of water made the openings of little value. The bottom of the channel was not reached, according to the man who performed the work, and not sufficient gold to pay for this method of mining was found in the upper gravel. The sixth portion, along the south side, is that which has received the most attention. A series of shallow open-cuts have been dug on the northward sloping bedrock, the dirt from which was ground-sluiced. Rockers and long-toms have also been used. The amount of gold obtained from the Tertiary river-bed is uncertain. Mr. Robert Seavers, of the Nevada State University, who has lived near this locality for many years, informed me that about $100,000 in all has been recovered.

Mining has been not only desultory, but also spasmodic. Nothing has been done within the last few years except driving the tunnel in Little valley. The higher portions are known to contain much gold in places, nearly sufficient to pay fair wages to a man with no more than an ordinary miner's pan. The fact that this ground is owned by the Virginia City Water Co. prevents more work being done. The portions south of Washoe valley may be further explored, but excess of water and a cap of lava have discouraged local operators.

To become commercially profitable the gravel must be worked in a large way by hydraulic methods. This places the problem as one of water-supply, to be controlled by the water company. As a matter of possibility, it is evident from the topographic map that water can be brought to all sections of the channel except those at the highest elevations. If the gold content justified it, as is not improbable, other methods for working these elevated portions might be used. Much water that performs no useful work is running off these hills, particularly at the period of melting snow. Exact engineering data are not at hand, though doubtless they might be obtained by proper arrangement with the water company. The present indications and conditions appear to warrant a serious consideration of the exploitation of these gravels in a large way.

Reinforced concrete mine-timbers, if such a hibernianism may be permitted, have been introduced by D. W. Shepard of Denver, involving a new method of reinforcing by trussed rods. By this system greater resistance is given to lateral strains, increasing the strength of the concrete member in the direction in which its weakness has in the past proved an obstacle to its use. Thus, it is claimed, caps of reinforced concrete may be made having within less compass and lower cost than ordinary timber, decidedly superior strength. The reinforcing rods employed are of ½-in. steel, and the size of post and cap proposed as standard by Mr. Shepard is 4 by 9 in. For permanent shafts and gangways it is conceivable that a system of this kind may present advantages which will commend it to increasing favor among mine managers, on account of the rapidly growing expense of timber and the generally decreasing cost of cement throughout the country as a result of competition.

A case of rapid repair to a power plant occurred recently when an engine at the Davidson Rubber Works in Charleston, Mass., was wrecked just at the close of the day's work, the cylinder-head and frame being demolished and the crank-pin broken. Two days later an order was placed with the Allis-Chalmers Co. for a 20 by 48 in. engine, and the new foundation was begun. The engine was shipped by express three days later, and on the fifth day after letting the contract it reached its destination. Parts of the old engine were used again and the crank was re-bored to fit the new pin. The erection was complete and the engine working under full load ten days from the date of placing the order.

The cost of dredging under favorable conditions should be estimated to be 8c. per yard for operating expenses and depreciation. Much lower results have been published, but these are often based on short periods or inaccurate book-keeping. Large dredges of 80,000 cu. yd. per month may average as low as 5c. for operation and depreciation.

MINING COSTS IN THE JOPLIN DISTRICT.

Written for the MINING AND SCIENTIFIC PRESS
By DOSS BRITTAIN.

The recent low prices in the spelter market and the resultant decline in the price of zinc ore have brought seriously to the minds of operators and investors the matter of mining costs in the Joplin district. The failure to make a correct estimate may lead to serious mistakes, not only on the part of the investor, but on that of the operator as well. Costs include the expense of mill and underground equipment, royalties, labor, power, explosives, insurance.

For an average acreage in the sheet-ground territory $35,000 for mill and underground equipment should be ample, $10,000 extra for prospecting, shaft-sinking, and opening up the ground in such manner as to supply the mill with material is a fair allowance. In the case of average sheet-ground, with due judgment exercised, this sum should prepare for mining a good run of ore.

The royalty depends on whether the operator is fee-owner, first or second lessee. If he is fee-owner there is no royalty; if first lessee, the royalty is from 10 to 15%; if second lessee, or sub-lessee, it is 20 to 25%, and sometimes as high as 30%. There are cases in the district where the first lease royalty is as low as 7%, but this is uncommon. The royalty in all cases is calculated on the gross sales of ore, the check in payment being made out to the fee-owner, who takes out his royalty, the remainder being transmitted to the lessee, who, if there is a sub-lessee, takes his royalty, and so on till after all the royalties are paid, the return from the ore sales reaches the operator, who must stand all mining expenses.

The workmen employed in a zinc and lead mine are paid as follows:

Engineer	$2.25	to	$4.25
Fireman			3.00
Hoist-man	2.50	"	2.75
Boulder-breakers			2.00
Tub-hookers	2.75	"	3.00
Shovelers (6 to 7c. per can)	3.00	"	3.50
Machine-men			2.75
Helpers			2.25
Powder-men	3.25	"	3.50
Pump-man	2.75	"	3.00
Tub-runner			2.25
Track-man			2.50
Crusher-feeder	2.25	"	2.75
Jig-man	4.00	"	5.00
Jig-man's helper			2.25
Sludge-men	2.00	"	2.25
Blacksmith	2.50	"	2.75
Boss (day)			5.00
Boss (night)			3.00

The superintendent is usually paid $150 per month.

There are three forms of power in use in the Joplin district, namely, steam, gas, and electricity. The cost of one horsepower-hour with the use of steam, and with coal at average prices, is 1.75 cents, running non-condensing, as does the ordinary steam-plant of the Joplin mill. Steam power with gas, non-condensing, costs about 0.75 c. per hp.-hr., while with gas condensing the cost is reduced to 0.5 cents. With gas in the ordinary type of gas-engine power is guaranteed to the operator by the gas-engine companies at 0.3 c. per hp.-hr., while some makes of engines actually produce it at 0.25 c., gas in the district being furnished at 1 c. per 1000 ft. Power by electricity is produced at 1.25 c. per hp.-hour.

The cost of explosives per ton of material broken varies greatly, but even in hard ground it should not exceed 10 to 12 cents.

Mills are insured in the Joplin district at a rate of $2.50 to $5 per $100 valuation, depending wholly on individual conditions. Companies are protected against all liability suits at a rate of 3½% of the payroll.

The actual cost of placing a ton of zinc concentrate in the bin is variously estimated from 50 cents to $1.50, the latter estimate including all the necessary expenses involved in a year's work, pumping, exploring, timbering, construction work, and general expense. The operation of mining crude ore includes:

Breaking ground	$0.41
Shoveling	0.21
Hoisting	0.14
Pumping	0.10
Exploring	0.10
Timbering	0.01
Total cost of mining	$0.97
Milling	0.25
General expense	0.14
Construction	0.12
Total cost	$1.48

The percentage of recoverable ore and the price therefor determines the amount of profit to be made. These figures are taken from a year's operation of a mine in hard ground.

The cost of handling a ton of material in the sheet-ground is itemized as follows:

Explosives	$0.12		
Shoveling	0.12		
Other labor underground	0.10		
Hoisting	0.01		
Milling	0.15	to	$0.17
Total	$0.50	to	$0.52

In the second estimate it will be observed that such expenses as pumping, timbering, exploring, and construction work are omitted, thus accounting for the great difference in cost. Timbering, of course, in sheet-ground is practically nil. The large difference in the cost of hoisting is accounted for by the fact that the first estimate includes also the hoisting of dead material as well as that milled. The difference in the milling is due to difference in the size of mills, those of the sheet-ground being of large tonnage.

Canvas pipes were always used in California for hydraulic mining in early days. Toward the end of 1853 pipes made of light sheet-iron were introduced to replace them. The first iron pipe was used by R. R. Craig on American hill, Nevada county. It consisted of about 100 ft. of stove-pipe. In 1856 a firm in San Francisco commenced the manufacture of wrought-iron pipes, and during 1857 a sheet-iron pipe 40 in. diam. was laid for a water conduit across a depression at Timbuctoo in Yuba county.

A MAKESHIFT ROASTING FURNACE.

Written for the MINING AND SCIENTIFIC PRESS
By HERBERT W. ROSS.

The Union Copper Mining Co. of Calaveras county, California, has a small smelter at Copperopolis. There is but one furnace, an oil-burning reverberatory. In the past, ore from the company's mine has been roasted in piles placed on the hill immediately back of the smelter. When burned these piles were covered with a temporary roof to exclude rain, and transferred as needed to the bedding bins behind the furnace. It was necessary to shovel the ore twice before charging it into the furnace hoppers. The original plan was to install McDougall roasters and treat concentrates, but the construction work was suspended.

The heap-roasted material charged into the furnace was of course cold and over-roasted. Owing to inadequate crushing facilities, rather coarse ore was delivered to the furnace. In order to prevent slag and matte from splashing on the roof, it was essential to dry damp ore before charging.

The average sulphur content of the ore received from the mine is about 13%. Several piles were built averaging less than 10% sulphur. The pine wood under these piles became saturated with water during the winter, and it was found impossible to fire the heaps. It became imperative to find a means for roasting this ore economically.

The reverberatory furnace is connected with a dust chamber 124 ft. long, and 12 ft. wide, 84 ft. of its length being covered with a sheet-iron floor. The chamber is built on the same level as the furnace. This dust-flue suggested itself as a substitute for a roasting-furnace, the waste heat from the reverberatory being utilized for roasting. This waste heat is excessive, owing to the infusible character of the highly aluminous slag that we are forced to make.

Five small charge hoppers have been placed in the runway above the dust-chamber. Seven sheet-iron discharge-chutes have been fastened to the side of the chamber so that hot calcine can be run by gravity into cars on the furnace-floor below. A hydraulic elevator that connected the furnace-floor and the charge-floor furnished a means for raising the roasted material to the furnace hoppers. To facilitate the handling of calcine, track was laid beneath the discharge-chutes of the dust-chamber and over the charge-hoppers of the reverberatory furnace. The total cost of labor and new material for construction amounted to $192.

As the furnace is connected with the middle of the chamber, it was necessary to supply heat to one end by means of an oil-burner. Ore and flux are delivered to each roaster-hopper in 1000-lb. charges, the rate of charging being so regulated that the desired amount of sulphur is expelled. Conical piles form beneath the charge-hoppers, fresh charges of ore spreading over the surface of the piles to a fairly uniform depth. We are unable to rabble the ore while roasting, and depend on each thin layer roasting sufficiently before the next is added. When enough ore has accumulated in one of the piles to make an eight-ton charge for the furnace, it is removed and the remaining calcine leveled before adding fresh ore. About 5% combined water and one fourth of the sulphur is expelled from the ore by this method of roasting.

We are able to obtain about 50 tons of hot calcine per day that will yield a 45% copper matte on smelting. The advantages of charging hot material have warranted the use of the furnace, regardless of service as a roaster. Both ore and flux are charged into the furnace hoppers at a red heat. Larger charges are permissible when using hot material, the charge spreading well on dropping. As the combined and free water have been expelled from the ore, little splashing occurs; this permits of charging more rapidly than is advisable with cold calcine, if injury to the roof is to be avoided.

Roasting in this furnace would enable us to handle green ore low in sulphur more economically than if heap-roasting is employed. Shoveling can be entirely avoided by the use of hopper-bottom bins. No precautions are necessary to keep the ore dry. A large ore-supply at the smelter will not be required. We have a method for roasting ore too low in sulphur to be suitable for heap-roasting. If the sulphur content is high or the ore finely crushed, the roasting is unsatisfactory. While the roaster cannot be regarded as very efficient, it enables us to roast the rather coarse material from our crushing plant and expel the small amount of sulphur we desire to burn off. Several thousand tons of low-grade ore have been smelted that could not have been treated without the use of the dust-chamber.

Stope drill competition has again been taken up in South Africa, the recent tests evidently not seeming conclusive. The Transvaal Government, in co-operation with the Transvaal Chamber of Mines, has arranged for a practical trial of small rock-drills suitable for narrow stoping work under the working conditions obtaining on the Witwatersrand. All types of rock-drill are eligible to compete. Drills using compressed air will be supplied with a pressure varying from 60 to 75 lb. per sq. in. at the working face. The mining regulations require the provision of dust-allaying appliances, and competitors must make provision accordingly.

Two prizes, of £4000 and £1000 respectively, are offered. The trials and the judging will be so arranged as to decide which machine performs the most economical work. The competition will commence early in 1909, and entries will probably close with the end of 1908. The trials will last about six months, the drills being tested in the first instance on the surface, and those considered suitable being given a more prolonged test underground in several stopes in various mines on the Witwatersrand. The detailed conditions governing the competition, including the exact date of closing entries, will be published as soon as possible.

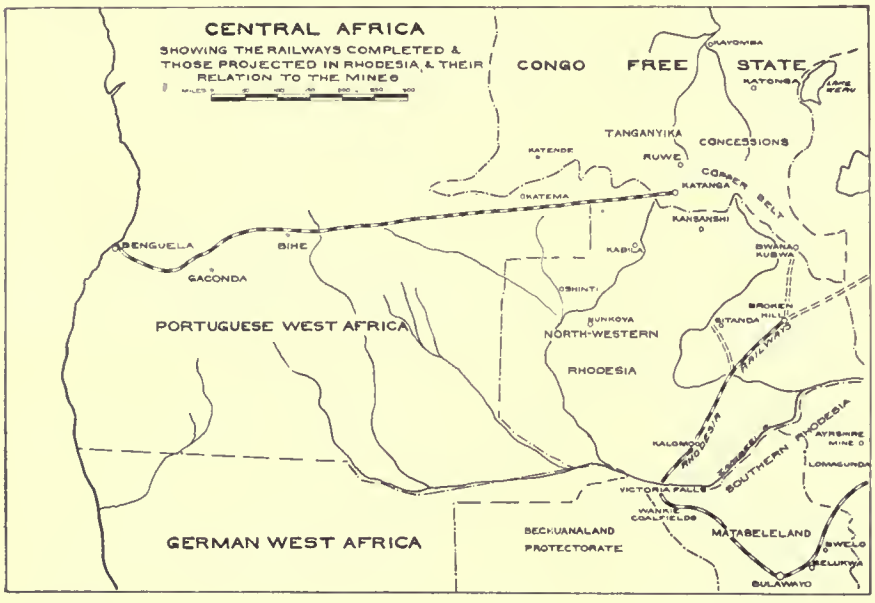
All enquiries should be addressed either to: The Secretary, Stope Drill Competition, Transvaal Chamber of Mines, Johannesburg, Transvaal, or to: The London Secretary, Transvaal Chamber of Mines, 202 Salisbury House, Finsbury Circus, London, E. C.

KANSANSHI MINE AND MINE SAMPLING.

Written for the MINING AND SCIENTIFIC PRESS
By J. R. FARRELL.

Kansanshi is the name given to an ancient copper mine situated at an elevation of 5000 ft. on one of the higher ridges making south from the Congo-Zambesi divide in northwestern Rhodesia. It is within 12 miles of the Congo Free State and is owned (as to 65%) by the Tanganyika Concessions Ltd. and (as to 35%) by the British South African Company.

Near the centre of the area is a low rounded hill on which are many trenches, and from this extends a series of parallel cuttings, mainly toward the south, from which former workers extracted a large tonnage. There are six principal lines of these cuttings, which vary from 300 to 1300 ft. long, from 3 to 30 ft. wide, and as much as 25 or 30 ft. deep. Along the sides are piled almost continuous heaps of stuff,



which in the aggregate make many thousands of tons but are not nearly sufficient to account for the material that has been taken out. These imposing cuttings, with their walls standing intact, make a splendid exposure of the upper portion of the vein, showing a dip to the east and the fracturing of the sandstone layers at nearly right angles so as to suggest a persistence in depth at least through the sandstone. Under conditions heretofore existing in that remote land it was not practicable to approximate the thickness of this surface sandstone, and any statement would have been a mere guess.

To test the mine below the old workings, shafts were sunk to 80 and 100 ft. and drifts extended on three of the veins: the broken rock was wheeled in barrows or carried in boxes to the shafts, dumped, shoveled into bark baskets, and windlassed to the surface by natives. In this manner a drift was made on D reef in continuous ore, averaging 8 to 10 ft. wide, for over 1000 ft.; on E reef, for more than 500 ft. on ore 2 to 3 ft. wide; on the 'new reef' for nearly the same length and 4 ft. wide. All these workings are on the 80-ft. level. In these drifts the ore was massive, filling the fissure from wall to wall, and in addition there was an impregnation of the sandstone from 6 to 10 ft. on either side. The ore exposed was of highest copper content toward the north, under the hill, where also was found a good excess of iron, but going south the copper grew gradually less and the iron was in like manner replaced by silica, but as opened, by care in mining, a self-fluxing mixture was obtainable for a length of 1000 ft. The copper ores were almost entirely carbonates and oxides, and the iron occurred as limonite, but sulphides of both metals also appeared. Detailed sampling showed all this ore to average 18.7% copper and $2 or $3 in gold. This was highly satisfactory, but not sufficient to justify a 300-mile extension of the Rhodesian Railways from the terminus at Broken Hill to Kansanshi, and therefore it was agreed to test the mine to a depth of 300 ft. This was an arduous and expensive undertaking, for a road had to be cut 300 miles through a wooded country, crossing rivers and swamps, and machinery for hoisting, pumping, and testing had to be brought by ox-teams, with the certainty that the oxen would die from bites of the tsetse fly and the wagons go to the scrap-heap. A new shaft was sunk and a level made at 134 ft., corresponding to 100 ft. of the previous work, and the different veins were again cut and explored, with excellent results. At 149 ft. the shaft passed out of the sandstone into a hard, slightly pyritic, and nearly barren limestone, in which it continued for 120 ft. Winzes were put down on the different veins and these bumped into the limestone, the veins one after another turning into the sandstone, bending to the west, and pinching out.

After the limestone had been entered the mine was examined by four engineers and one geologist, all holding important positions, and all of them assumed that the sandstone was lying conformably upon the limestone into which, so they stated, the copper veins did not penetrate; in other words, the mine had been bottomed. Yet at the time four of these investigators were at the property, the following exposures had been made, namely, at a depth of 234 ft. cross-cuts had been started east and west in the limestone; at 35 ft. east of the shaft the ore had passed into black schist dipping 7° west; the bottom of the shaft had entered similar material; the main cross-cut on the upper level had been extended west beyond the ore veins and was in black schist; and in the other direction, under Kansanshi hill, the sandstone had been gradually altered into quartzite.

However, the importance of these facts as noted in the former statements of weekly progress reported to London was appreciated, and a cable was sent to the local manager to sink a winze from the extreme west end of the upper cross-cut. The result was that, even before some of the engineer's opinions were at

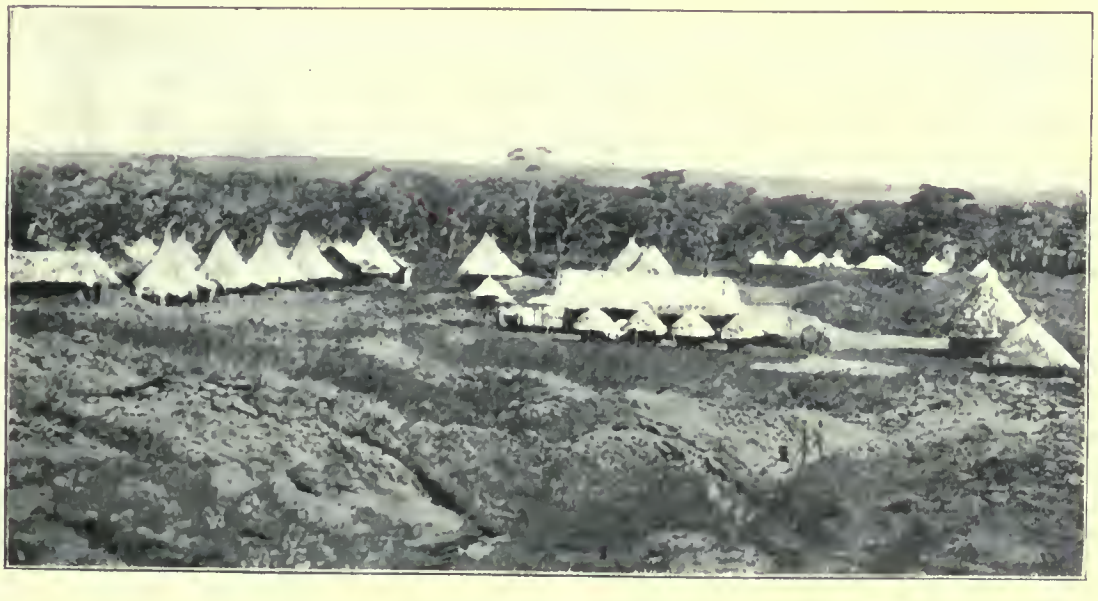
hand, the manager reported this winze had cut a strong vein of good ore dipping 70° west with a limestone foot-wall and a schist hanging wall. Sinking on this vein continued, the cross-cut west on the second level was also extended and connection made in a wide vein of fine ore, a body of water being also tapped. The latest reports state that the vein is holding so well that indications point to its being very persistent and that the copper-bearing solutions came from below. The carbonate ores continue and it is not known as yet where the sulphide zone will appear, but all the sulphide so far found has been rich.

It looks now as if the following had taken place at Kansanshi: In a former geological period a disturbance tilted the country so greatly as to uplift the limestone bed to its present position with a dip of 70° west and caused the formation of the copper-bearing vein. Next a bed of sandstone over 150 ft. thick was deposited unconformably upon the tilted limestone. Gradually vapors accumulated, because of thermal activity, exerting a pressure that altered some of the sandstone into quartzite and finally forced up Kansanshi hill, fracturing the overlying sandstone along the great series of surface veins, which became filled with their present copper content. Some of the solutions also overflowed, so as to kill the vegetation of the 70 acres of country about the site of the present mine, though woods cover the country outside of this particular tract.

This development has been important and valuable for the Kansanshi mine, but is of much more interest as a straw indicating what may have happened at the Katanga copper mines immediately to the north. It is now understood and admitted that Katanga is a copper zone extending for 200 miles in a sandstone country containing large and valuable deposits of oxidized copper ores. In each of these deposits, the widths of several being measured in hundreds of feet, is a central core of porous quartz ore on either side of which is a wide layer of most beautifully stratified and laminated sandstone ore, and the grade is such that there will be little or no difficulty for many years in maintaining an average of 15% for a plant handling 1,000,000 tons per annum. In places these deposits dip with the sandstone layers, at others they

Kansanshi, Shaft E.

are nearly at right angles; they are found in anticlines, synclines, and rolls, but ordinary theories for copper deposits do not account for their occurrence. Each of the engineers who has visited the region has advanced his own theory as to their origin, and it is peculiar and noticeable that one and all have pursued the unusual method of referring more or less directly to the formation of the continent of Africa itself, speaking of when it was oceanically immersed and uplifted. This may indicate the extent and importance of the region, but when engineers start with the



Kansanshi Camp, 1902.

creation of a continent, it hardly can be expected they will be in close agreement as to the exact genesis of local mineral deposits. The region is so remote, the difficulties in the way of investigation so onerous, and the need so slight for making deep workings on hills that will yield millions of tons by quarrying; that it must be a long time before close study definitely determines the nature and origin of the ore-bodies. In the meanwhile such facts as are contributed by the development at Kansanshi are of more than passing interest.

One other fact has come to light to which it would be inexcusable to refer but for this tendency to theorize on a continental scale. Far off to the west, where, 1000 miles along the watershed from Katanga, the Central African plateau breaks away to the Atlantic littoral, another ancient copper mine was found, at Kasenya hill. The slope below the old workings was covered with float, and some tons of this were gathered and sent to London for investigation. It was found to have no commercial value, for it carried only 3 to 4% copper and the rest silica, but it was interesting material. Boulders, like cobble-stones, were found thinly crusted with chrysocolla; chunks of sand showed the grains loosely cemented by the same material, while pebbles, rock fragments, and loam were similarly held together, while now and again specks and small splashes of flour-gold were visible. It was the very stuff that would result from water carrying chrysocolla and gold in solution trickling down the side of a hill. Three cross-cut entries were made under the old workings and these cut a mass of brecciated quartz, the pieces of which were crusted and held together, as was the float, and specks of gold were again in evidence. The conclusion was reached that this deposit came from subterranean copper and gold-bearing waters, perhaps a thermal spring, coursing through the broken rocks and overflowing at the surface. This may be another indicator for Katanga.

Referring to all these mines, it will not be out of place for me to recite the following personal experience on the subject of mine sampling: In 1902, as head engineer for the Tanganyika Concessions, Ltd., I was called upon to be the first to visit Katanga, size it up, and lay out such work, if any, as I thought advisable. To reach there, I had to travel over 1000 miles, half of this distance on foot with carriers, north from Bulawayo into Central Africa. Arriving on the ground, I was alone for practical purposes of mining engineering, being instructed to take no man needing European food, other than master of transport, north of the Kafue river, and carrier service from the east coast being delayed, owing largely to a violent epidemic of smallpox in northeastern Rhodesia, I had neither pick, hammer, drill, stick of powder, nor foot of fuse—a prospector's pick and shovel was all I could use. Moreover, food, particularly native food, was scarce. In this shape I was guided along the belt, word being sent to villages in advance so that native food could be provided for one day at a mine and for another to take us to the next copper deposit. So it was possible to remain but a single day at most of the properties, some of which are so extensive that it is beyond the physical endurance of any white man to even walk over them fully in that time and in that climate. The method of procedure was as follows: At daylight I would go to a mine from the night camp to look it over generally; back to breakfast, and then, if the deposit seemed to justify, return with transit and tape-line to approximate the position, shape, and dimensions of the property; back to camp for rest during the hours of mid-day heat, and then out again in the afternoon for such sampling as conditions would permit. On some of the hills no white man had ever before set foot. Even had local conditions permitted close sampling, there was no assay material in Central Africa other than the very limited amount at Kansanshi, over 100 miles distant, and carriers to carry weighty samples in any quantity were difficult to obtain. Even those I had were clamoring every few days to be paid off and sent to their village. Time too was precious, for the rainy fever season was approaching, and it was over 1000 miles through a starvation land back to Bulawayo. These were the conditions under which the Katanga mines were first examined and sampled. It may not have been scientific, but it was all that could be done; yet so well had nature exposed the mines, so enormous had been the native work during the centuries, and so generally similar the ore occurrence, that I was entirely certain of my conclusions and did not hesitate to so report. My business there was to size up a great mineral belt and lay out work to be done upon it, and it speaks well for the country that what was then said and done has not had to be changed in any material particular, and the enterprise has grown meantime into an undertaking of gigantic character.

Now it came to pass about the time my report was made public, technical papers were giving considerable attention to the subject of mine sampling and the apparently 'fairy tales' from Central Africa seemed to afford a good example of how this important work should not be done. It all serves to illustrate how easy it may be to write down comfortably just how some things should be done, and how necessary for the man on the ground to do the best he can.

On the other side is the following: The upper works of Kansanshi were twice sampled in great detail at measured distances and the 'ore fully developed,' 'ore partly developed,' and 'probable ore' calculated to a nicety in different interests, once a few months before and once a few months after the limestone was met with. So finely and accurately was this work done that the average assay-values were identical, 18.7% copper, with a difference of a couple of hundred tons out of many thousand, and yet it was all unnecessary and wasteful. The mine was being opened, hoping to justify the extension of the Rhodesian railway, and if, as was reported, it had been bottomed "and all it would ever yield could be reckoned up," there was no occasion to reckon it up, for it was then clearly insufficient in quantity to justify the construction without which it was valueless, no matter what its grade. It will have to be done all over again some day.

FUMES FROM METALLURGICAL WORKS.

*The devastation of the forests in Tennessee, California, and Pennsylvania, as shown by Haywood and Buckhout, appear to be uncontrovertible evidence of the ravages of smelter fumes. Manufacturers at times have undoubtedly shown an utter disregard for neighbors, and the gases have been allowed to escape, which created havoc. These should be dealt with speedily. The tracing of an injury to fumes, except, of course, in such flagrant cases referred to, is not easy. The proximity of a chemical works with some people is prima facie evidence of the cause of all the trouble. Freytag has stated that the "assumption of an invisible injury done to vegetation by the smelter works vapors and the awarding of damages founded thereon are unwarranted." When smells characteristic of the factory are noted to the windward, the evidence to the lay mind is most convincing. Chemical factories do generate gases that are objectionable. None is surer of this than the manufacturer himself. Sometimes these gases are actually poisonous. Oftentimes they are not. But inasmuch as they smell, they are objectionable. This constitutes a nuisance, and suits for alleged injury from chemical fumes have been a source of great annoyance to manufacturers in consequence. Even when poisonous gases escape by accident, or otherwise, they may be rendered comparatively harmless, if sufficiently diluted. We say 'comparatively,' for, as is well known, the sulphur gases from the combustion of coal in cities on a large scale, aided by soot, do produce slow, but far-reaching and constant injury to exposed works of art, libraries, draperies, and decorations of our homes, as well as those in public repositories. Dr. Baskerville showed that sulphuric acid, calculated at 80 per cent, is produced to the extent of 1300 tons daily in the atmosphere of New York City from the combustion of 9,000,000 tons of anthracite and 4,000,000 tons of bituminous coal per year. This is in addition to the soft coal supplied to steamships. And it has nothing to do with chemical works or smelters. It is simply the result of the amount of coal consumed regularly for heating and other purposes in New York City. From many determinations of the acidity of the air around factories, which as a rule are situated in sparsely settled places, under all kinds of topographical and weather conditions, it has been learned that the acidity is often far less than that observed in large cities. Therefore, placing the blame upon chemical works has not always been a square deal.

The growth of vegetation is affected by many factors, some happening in the ordinary course of events and others occurring only on extraordinary occasions. A weak and stunted growth, smaller leaves, shorter twigs, lack of normal green color indicates unfavorable conditions for growth. The inattentive multitude attribute such a state of affairs to drought, heat, frost, blight, smoke, or gases in the air. These 'gases in the air' may come from legitimate sources, but it must be remarked that however perfect the smoke consumption may be, the sulphides are still in a large measure burned to the oxides of sulphur. This may be obviated only by the use of electrical energy or peat or wood or of producer gas for power and heating purposes. The former are out of the question now on the score of expense. Thirteen billion cubic feet of gas were sent out on the island of Manhattan in 1906. This gave only 230 tons of sulphuric acid into the air, a minor item when we contemplate the other figures. Dr. Schaefer has pointed out that the presence of sulphur dioxide in the air may be the cause of respiratory diseases, yet it is fortunate that it also exercises a disinfectant action as well. A more serious cause of disease in large cities is street dust. This will not be done away with until the automobile has replaced the horse. Until that occurs the objectionable sulphur dioxide does serve a good purpose.

Chemical works, as a rule, are not operated by small concerns. Any large corporation, especially if it has acquired the pseudonym of a 'trust,' unfortunately is looked upon as fair game for a species of blackmail. Especially is this so where there is a semblance of truth beneath the claims. In rural communities, where factories are usually located, the farmer with half a case, if he be not first worn out or financially embarrassed by the familiar repeated delays in securing a trial, will obtain a verdict against such an organization as long as the present sociological and political ideas obtain in those communities, or until certain abuses of the centralization of capital are remedied. And the 'good trust' suffers with the 'bad trust' as a result. To obviate injustice, Professor Baskerville has suggested, perhaps not for the first time, that such suits, dependent upon technical knowledge, be settled by a commission of experts, properly appointed, which shall first determine if damage has been done, and then the amount which should be paid in compensation. In this connection it may be said that there is neither uniformity nor definiteness of statement in the codes of our several States in regard to the contamination of the air or the pollution of our streams. When a plant in New Jersey may generate gases which are complained of in New York, or when smelter fumes produced in Tennessee affect the vegetation in Georgia, it becomes a Federal matter. We are not over-enthusiastic on the rapid growth of the paternalistic policy of our Federal Government, but it would appear to be advisable for the Department of Agriculture to extend its investigations, co-operate with similar departments of the several States, and recommend the enactment of a uniform and definite law. The Government officials would undoubtedly receive cordial co-operation on the part of the works owners.

*From 'Electrochemical and Metallurgical Industry,' April, 1908.

The sides of the Culebra cut on the Panama Canal are to be cut smooth by channeling machines. The canal commission has purchased 24 Sullivan channelers of the largest size, and will put them in use at Culebra, when the lower part of the excavation is undertaken. The only previous use of channeling machines on a scale approaching this was on the Chicago drainage canal, where channelers were also used in the rock sections.

The Prospector.

Owing to the large number of specimens forwarded to this department, it has been found necessary in future to make a charge of 25 cents to subscribers for each determination, and $3 to non-subscribers.

Aragonite was sent by W. H. W., of Ballarat, California.

A specimen of magnetite came from Alamos, Mex., marked J. R. H.

The specimens received from J. S. L., of Ibapah, Utah, are both quartzite.

C. W., of Wadsworth, Nev., sends: No. 1, white barite; No. 2, black obsidian.

Quartz containing manganese dioxide was received from La Grande, Ore., marked I. H. S.

The two specimens sent by F. B., of Jerome, Ariz., are: No. 1, chalcedony; No. 2, quartzite.

E. W. S., of White Bird, Idaho, sends muscovite and chlorite flakes from a disintegrated chloritic rock.

A specimen of metamorphosed rock, mostly quartzite with pyrite, was received from G. F. Y., of Pony, Montana.

D. F., of Goldfield, Nev., sends rhyolite or trachyte showing a glassy sanidine feldspar and black biotite crystals in a vitrophyric base.

The specimens received from W. E. S., of Quartzsite, Ariz., are: No. 1, quartz with specular hematite; No. 2, altered pegmatitic rock; No. 3, diorite; No. 4, quartz and specular hematite; No. 5, free gold in a metamorphic serpentinized rock. Also a specimen of cyanite-schist was sent.

The poured concrete house heralded as an invention of Thomas A. Edison is novel only in the matter of the forms in which the house is moulded. The moulds consist of cast-iron plates less than an inch thick, with milled edges and faces having flanged joints drilled for dowel-pin and bolt connections. The inner surfaces of the plates will be nickel plated or faced with brass where ornamental finish upon the concrete is required. All the details of bearings for reinforcing rods, and ways for plumbing connections and electric wiring, are provided, and the moulds properly numbered for speedy erection. It is proposed to employ steam or electric platform derricks for handling the moulds in erecting and in taking down. Economy in construction with the Edison system will result only through duplication of the same structure, with the same set of moulds. It is estimated that a set for a two-story house of eight rooms will cost less than $40,000, and that such houses may be built for less than $2000 with cement at $1.50 per bbl. Mr. Edison proposes to use a mixture of 1 part cement, 3 parts fine sand, and 5 parts crushed stone or gravel passing a ½-in. ring.

Decisions Relating to Mining.

Specially reported for the MINING AND SCIENTIFIC PRESS.

The mere placing of a tent and a few tools and a small supply of provisions upon a placer mining claim, are not sufficient alone and of themselves to constitute actual possession. But where a prospector has in good faith temporarily gone away from his claim for the purpose of purchasing provisions or supplies or for any other temporary purpose, intending to return and resume his actual occupation, possession, and labors, such temporary absence is not to be construed to be an abandonment of his right to the ground, and that one of his rights to the claim, and another entering upon the claim during such temporary absence could not initiate any right thereto.

Charlton *v.* Kelly, (Alaska) 156 Federal 433, Oct., '07.

To constitute a mining partnership it is necessary that the joint owners of the mine actually engage in working the mine or in the business of operating the mine. The mere co-tenancy of two or more persons in a mining scheme is not of itself sufficient to constitute them mining partners. But it is not essential that all the tenants join in the work of mining in order to establish the partnership; that relation may be established among such of the joint owners as actually engaged in the working or mining operations. The joint owners not so joining in the work are left to their rights and chargeable by their duties as co-tenants only.

Madar *v.* Norman, (Idaho) 92 Pac. 572, Nov., '07.

A broker was given authority to sell a mining lease on specified terms. He procured a promoter, who combined with the purchaser and fraudulently dealt with the seller for the purpose of defeating the broker's claim for commission. In an action by the broker for his commission the court held he was entitled to his commission though the seller did not know that such promoter and the purchaser were acting in conjunction and though the purchaser obtained was not himself able to buy and pay for the property.

Glade *v.* Eastern Illinois Mining Co., (Mo. App.) 107 Southwest. 1002, Feb., '08.

A statute required coal mine operators to have the roadways in their mines sprinkled, and required the inspectors to see that all possible precautions were taken against the occurrence of explosions which might be caused or aggravated by the presence of dust. In an action by a miner for injuries it was held that the willful failure of the manager or examiner to observe the statute was the willful failure of the operator, though the operator had in fact no actual knowledge of the delinquency of the manager or examiner, and though the examiner had a statutory certificate. And the manager's knowledge that for many days the roadway in the mine needed cleaning or sprinkling, and failed to have it done, was a conscious omission to perform a duty and a willful violation of the statute.

Davis *v.* Illinois Collieries Co., (Ill.) 83 Northeast. 836, Feb., '08.

The fact that a particular brand of fuse furnished by a mining company for use by its miners, was in general use for such purposes, and was favorably known, was not conclusive evidence that the company was not guilty of negligence in furnishing that particular kind of fuse to its miners, and the fact that a better and safer kind of fuse had been introduced within recent years and come into common use, was not conclusive evidence that the company was negligent in using the older kind. Such facts were said to be evidence for the consideration of the jury in determining whether the employer failed to exercise the degree of care required by the circumstances, the nature of the instrumentalities, and the danger to be anticipated from defective appliances.

Wiita *v.* Interstate Iron Co., (Minn.) 115 Northwest. 169, Feb., '08.

GEOLOGY.

By James F. Kemp.

(*Continued from page 500.*)

But there are some further interesting features which are displayed by the volcanic centres. We often find cases where practically the same vent has been active for a long period of time, yet where it has furnished successive varieties of lava in a more or less regular series. Rocks of intermediate composition are usually the first to appear. They yield on analysis 50 to 60% in silica and their specific gravity is of mean values. They are followed by others successively higher in silica and of lighter specific gravity. Then appears a marked drop to the last outbreaks of rocks, low in silica, high in iron and related bases and of relatively great specific gravity. Thus we have what Ferdinand von Richthofen called many years ago "the natural succession of the volcanic rocks." Increasing experience has shown that we must admit some variation in the regularity of this series, and that there is sometimes a recurrence to the first variety, but on the whole, the general succession holds good and involves an important truth. In order to account for it, we have come to believe in temporary reservoirs at depths not so great as to preclude fusion and in which the molten rock stands liquid for long periods of time. An original homogeneous mass then breaks up or differentiates into fractional parts. The lightest or most silicious rises to the top, the heaviest or most basic sinks to the bottom. Successive eruptions are marked first by a rock of medium specific gravity and chemical composition, next by those lighter and lighter, or higher and higher, in silica as the upper layers are tapped off, finally closing with the heavy, basic dregs or settlings of the molten mass. The extinct volcanic areas of Nevada and Arizona have given fruitful evidence upon this point, and where the original type of rock re-appears after its normal period has passed, we have concluded that renewed viscous flow has fed again the reservoir from deeper seated stores.

The phenomena of volcanoes, the increasing temperature as we descend in mines or as we test deep bore-holes with self-registering thermometers, as has been done most of all in America by our Professor Halloek, together with other less familiar phenomena which I do not cite, have all led us to the belief that the temperature of the earth continues to increase as depth grows greater. This conclusion is fundamental to some of the points just made, and is probably well justified. But as regards the profound depths the rate may not hold. Some mathematical students of the subject have reached the conclusion that the rate falls off greatly, and, regarding this, opinions may be said to differ, but there is no good reason to doubt that at least for relatively great distances the interior is highly heated.

Volcanic phenomena and the problem of the interior heat have been the objects of greatly increased interest in recent years because of the remarkable and destructive outbreaks in the lesser Antilles and from Vesuvius. In two particulars, Mont Pélè in Martinique has added phenomena previously unfamiliar. The descending blast of heated gas that wrecked St. Pierre with its tens of thousands of people was on a scale not formerly observed, and by its destruction of life aroused human sympathy as well as stimulated scientific research. The subsequent protrusion of the extraordinary spine of solid yet highly heated lava from the crater gave a striking illustration of a mass of rock passing upward in a viscous state, then solidifying before it emerged, but remaining red hot and steaming after it projected above the surface. Unfortunately it has fallen away and no longer stands as a monument to the dead buried at the foot of the cone.

There is one very recent suggestion regarding the problem of internal heat, with its corollaries, the volcanoes and the earthquake. It is the possible bearing of radio-activity. The recent discoveries that certain rare elements or so-called elements pass through a series of changes, ordinarily described as "breaking down" into other substances, with the parallel development of heat; and the further discovery of the radio-active character of the volcanic rocks and their emissions, have brought prominently before our minds the possibility that herein lies a cause of the internal heat and of the emitted lavas. The idea is so new that it is as yet little more than a suggestion, but we all realize that it may be fraught with important consequences for the future and its development in the years lying immediately before us will be watched with intense interest.

It has been impossible to pass in review the topics hitherto treated without constantly introducing the idea of time, and of time so indefinite in character that we describe it as geological in distinction from the usual measurable durations. Geology brings us irresistibly face to face with stretches inconceivably long which elude our grasp as do the distances of the astronomers. Some bold mathematical spirits have sought to calculate the age of the earth from the assumed nebulous conditions to the present. The results have varied from twenty millions to several hundreds of millions of years. Perhaps one hundred millions is generally accepted as a fair attempt at a solution upon such uncertain data. If we drift away from the nebular hypothesis we lose even these data and must attack the problem along new lines. If A. C. Lane succeeds in establishing from his samples of deep-well water the composition of the pre-Cambrian sea, and if we can calculate the rate at which rivers have poured their dissolved salts into the ocean, then we may attain an approximate idea of the time period required to raise the ocean to its present concentration.

With all these very long durations, great uncertainty is involved. Better success has been met with smaller ones, and in several cases the solutions attain much interest. The Falls of Niagara have furnished on the whole the most significant instance, and the one upon which the greatest efforts have been expended. We can but wonder if when Father Hennepin looked upon them in 1768 and felt overwhelmed, as he tells us, with the tumult of the waters, the thought did not pass through his mind

as to the length of time during which the river had been at work since the crest was seven miles away toward the north. The question looks so simple at first glance that it seems as if it were merely a matter of arithmetic to observe for a time the rate per year of the recession and then divide this into the length of the gorge. If the recession is two feet per year, and the gorge is seven miles long, something like 18,000 years would be required. But we have learned that there are a number of uncertain factors. While the American Falls may retreat less than a foot per year, and even for ten years at a stretch draw back less than two inches annually, the Canadian Falls, after ranging about two feet for many years, may average five for five years running. The crest is now very broad; yet obviously it has been much narrower throughout the greater part of its history. At the Whirlpool Rapids we find an older channel, one antedating the Glacial epoch, which must have headed once somewhere upstream and which can be followed out to the north. Thus, the Niagara river, as we know it on the retiring of the great ice sheet, found a part of its gorge already cut. The part was probably a modest fraction, but we have no means of determining exactly how much. It has also been demonstrated that below the Whirlpool Rapids, at what is called the Foster Flats, the river ran in a narrow western and broad eastern channel, with a small island between, much as now, but on a different scale. Still making all allowances for these facts and variations, and recognizing that the present Niagara began its work when the continental glacier in retreating uncovered its drainage area and outlet, we generally believe that not less than 10,000 nor more than 50,000 years have elapsed.

Within the last few years geologists have been impressed with the line of attack furnished by measurements of radio-activity. It has been shown that not only eruptive rocks, but also both the waters and the surface deposits of up-rising, deep-seated springs display these phenomena in determinable degrees. In the latter case the radio-activity of freshly deposited material is the greatest, and from this condition the amount falls off at a fairly well understood rate per year. If an observer, for instance in the Yellowstone Park, determines the radio-activity of freshly deposited calcareous matter at the Mammoth Hot Springs, and then makes a similar determination on ancient incrustations at the base of an abandoned terrace, the lapse of time since the latter began is within his grasp. In this way we have learned that a thousand years ago a certain deposit began on the glacial drift, and with more determinations of a similar character we may learn when these hot springs first began. The method is very new, but promises results both of importance and of general interest.

Geology touches human affairs most closely on the side of mining and related enterprises, and there is no more interesting chapter in its history than the one relating to these services. Mining is a very old occupation. Civilization could scarcely advance without the aid of the metals, and modern civilization owes one of its greatest debts to coal.

When, however, an engineer is face to face with the actual problems of removing these materials from the earth in the most economical way, and when he must plan such operations for a period of years, it is fundamentally necessary that he should have correct geological conceptions of their origin and structure. That our usual coal seams are ancient accumulations of vegetable tissue, deposited under quiet waters in the long course of swamp growth, no properly informed person can longer doubt. That they have been folded, often faulted, and always eroded until we have but the remnants of their past extent, admits of no question. The simple facts and principles of structural geology lie at the foundation of this branch of the mining industry and have been long established. Nevertheless, as to the exact processes which have brought carboniferous or cretaceous muck, peat, and lignite along the road to the distant goal of anthracite, we are yet in debate. That the original plant tissue of the anthracite seams was so long exposed before burial under the sediments which followed hard upon it, that it had lost the greater part of its volatile constituents and readily became the dense, hard, smokeless coal which we in the East so much prize, is the acute suggestion of Professor Stevenson, and his explanation fits the Pennsylvania case much better than any other. Yet not a few are pondering the question, and some think that a more open-textured cover of rocks has permitted the gases incident and necessary to the change to more freely form and escape in the anthracite areas than in the bituminous. Some again think that the mechanical heat produced in folding, or the interior heat of the earth made available by relatively deep burial under later strata, or the neighborhood of lower lying but as yet undiscovered eruptive rocks with their stores of heat, have brought about the changes. Upon this problem many are therefore still disposed to ponder.

Again, speaking of coals both bituminous and anthracite, we may question as follows: Were they once leaves, twigs, branches, and woody tissues generally, or were they largely spores of cryptogams. If we also admit to our field of view the interesting group which embraces the cannels and the exceptionally gaseous coals, from which to this day illuminating oils are distilled in Scotland and in New South Wales, we may ask: Were they enriched with animal matter such as fish, making them fry and sputter in our grates like so much fat; or were they due to the enormously rapid multiplication of freshwater algae in a single season, as Bertrand of Lille has inferred from his microscopic studies of the Franco-Belgian occurrences. If this is true, then for these coals our old ideas of slow accumulation and protracted time are unnecessary, and carbonaceous deposits may have gathered with a rapidity of which we had no proper grasp. And then there are the strange asphaltic coals which fill the fissures across our strata of sandstone and shale; representing thus the inflow of long extinct petroleum springs, now evaporated and oxidized to a shining black residuum —vein fillings they are, analogous to those metalliferous deposits to which I shall shortly pass. They

connect the coals with petroleum and natural gases and lead us to ask: Whence came the oils that gave rise to them and to our subterranean pools, which have so long remained stored up in the liquid form awaiting the drill? Are they too fractional products from long-buried plants and animals, gradually emitted during decomposition or gentle distillation, as almost all of us in America believe; or are they outgivings from molten rock which has never reached the surface and which has been forced to steam and fume in the confinement of the lower world? A few observers urge this view, and a still smaller number, mostly laboratory workers, without the steadying influence of field experience, have suggested that there are inner zones of the earth composed of metallic carbides, or even of metallic alkalies, to which waters charged with carbonic acid and atmospheric air penetrate and are there changed into petroleum and natural gas. These latter are views flatly contradicted and rendered impossible by the assured physical condition of the interior.

From asphaltic coals in fissures and veins, we pass to the metalliferous minerals in similar relationships. Always when we speak of veins, the precious metals more especially fill our field of view, and what romantic and fascinating chapters in human history they suggest! We mining people think that from the time when primitive man realized his need of metals, no influence in the world's history has been so potent to cause migrations as the desire to find the silver and the gold of new countries. The Spaniards certainly came to North, Central, and South America chiefly to gain them. The Englishmen hastened in droves to Australia. Occidental and Oriental alike formed the mad rush to California. The stolid Dutchman of South Africa was swamped by the flood of English, German, French, and American gold-seekers on the Rand. Nor in our own day could the icy barrier of Alaskan cold stave off the tide of fortune-seekers. We sometimes think that in the settlement of this staid and sober part of America the longing for religious or political freedom almost solely brought the settlers. But the legends of the old silver mines still linger in the Highlands of the Hudson, and the hills of New England do not lack shafts and pits now long gone to ruin. Who will say to what extent these monuments to dead and buried hopes may not indicate the alluring influences of gold and silver in the unknown wilderness.

Wherever rich enough to mine, the metals are found in a greatly concentrated state as compared with the earth at large. They so often fill crevices which traverse the rocks as veins cross the human hand, that the name vein has long been applied in this connection. The figurative use of the word is also happy, in that the metallic minerals, as well as their associates of no value, have been obviously brought to their resting places by circulating waters, which in the miner's phrase have nourished and enriched the crevices as does the blood the body. The veins again are, as it were, wounds or gashes in the earth which have been healed by the circulations. That water has accomplished the task few doubt. The earlier observers were accustomed to attribute the subterranean waters to the rainfall, and until recently all of us who have specially studied these phenomena have fallen in with the same view. From the clouds the rains descend upon the earth's surface. In part they run off in the stream; in part they evaporate, and in part they pass into the ground, where for ages they have accumulated as the ground-water and where they constantly renew the supply. The ground-water fills our wells, pours into the shafts of our mines as we sink, and forces us to pump. It stands beneath almost all parts of the surface, at depths, depending partly on the amount of rainfall and partly on the nature of the rock. We formerly believed that the ground-water continued downward in the crevices of the rocks to great depths, far enough, in fact, to come under the influence of the internal heat of the earth, and that it was set in circulation partly by this and partly by the heat afforded by those portions which, entering the ground on the heights, forced up the shorter columns after a greater or less underground journey. In the depths where heat and pressure were influential the waters were believed to be active solvents, and in their wanderings through the narrow pores and spaces of the rocks they gathered up the metallic and non-metallic minerals and deposited them in the veins when they rose to higher levels. In the journey toward the upper world diminishing heat and pressure led to precipitation of dissolved contents. In former years we had no very definite conceptions of accessible depths, but the mathematical analysis of Professor Hoskins of the University of Wisconsin, combined with the geological observations and reasoning of President Van Hise of the same institution, has shown that cavities become impossibilities in the softer rocks at say 500 metres, and in the most resistant at or about 10,000. That is to say, under the irresistible crush of the overlying column, rocks hard or soft weld together into a solid mass. Circulating waters descending from the surface must be limited to these depths as the extreme.

But in the shafts, which are rapidly exploring lower and lower rocks in many localities and are changing inferences to observation, the experience of the miner has shown that in regions remote from recently extinct volcanic activity, the ground-waters end at a comparatively shallow distance. If while the shaft goes constantly downward the miner impounds the waters encountered at the upper levels, he meets no more below 1000 or 1500 ft. But the veins are known in many cases to continue certainly to three times this depth, and we have been forced to cast about for some other source than the rainfall for the subterranean circulations which have originally brought in the ores. Other waters have been suggested by two chief facts of observation. Whenever the volcanoes break forth in eruption, clouds and clouds of steam and other gases go violently into the atmosphere, and when the lava wells upward from the vent and pours abroad over the crater slopes and surrounding country, it steams for many months before it is exhausted of its dissolved vapors. Molten rock in the depths of the earth must be well nigh saturated with the pent-up gases, which are

only held in check by the surrounding envelope of the crust. We have even thought, with much reason, that the steam given forth by eruptive rocks in early stages of the earth's history has condensed as the oceans, and that thus the oceans have been derived from the volcanoes, not the volcanoes caused by the percolating oceanic waters, according to the more popular view.

The second significant point is that in almost all of our own mining districts where the operations are based on veins, eruptive rocks are a marked feature. In many, there seems no escape from the conclusion that they are in some way intimately associated with the formation of the veins which have come in as the end-product in their expiring activity.

Thus a large proportion of mining geologists and an even larger number of mining men accustomed to deal with the familiar phenomena of western ore deposits, have swung around to a belief in the waters from the eruptive rocks as the agents and vehicles of deposition. Even the prospector looks upon the eruptive dike as one of the best guides in his searching. When, therefore, a mass of molten rock charged with its burden of dissolved vapors and gases rises from the depths, and stops without reaching the surface, it slowly cools, congeals, and emits the vapors as the source of the mineral bearing waters which continue onward to the upper world. They start highly heated, under great pressure. They constantly cool as they go and the pressure diminishes. The dissolved minerals precipitate upon the walls of the fissures, quartz and gold in one region, silver ores with copper, lead, or zinc in another. Layer on layer they grow, until the water-course is choked or the fires below burn out, the steam pressure falls, and the circulation ceases. Water on the surface now begins its work, the rocks are worn away, the fragments of the vein roll down the mountain side and form the trail, which, catching the eye of the prospector, guides him to the outcrop.

But has geology made no broad and general contributions to human thought and life? Surely when we pause for a moment and reflect upon the changes through which our views of the earth and its development have passed in the century and a half now closing, we must admit that its influence has been enlarging and beneficial. Recall if you will the gross ignorance that prevailed about the age of the earth; the ridiculously insufficient conceptions of time; the idea that fossils were the sports of nature, entombed in the rocks to deceive or amuse mankind; the failure to grasp the plainest lessons of geological structure; and the absurd positive notions of the earth which once prevailed. Then we realize that into the mind of every man of even ordinary education and reading has come a flood of new light. Under the guidance of geology we see the long and stately panorama of the past unfold. Mountains rise and disappear; sea and land repeatedly change places. Majestic forces in orderly succession perform their work; and development, whose course we may follow and whose processes understand, is made clear before our eyes. We feel ourselves as it were upon some mountain summit looking ever away and away into regions beyond.

TIN ORE AT SPOKANE.

The discovery of tin ore at Silver Hill, southeast of Spokane, Wash., in 1907, has attracted considerable attention. Search for metalliferous deposits and for coal has been carried on at this place for several years, and prospects of silver-bearing galena had been noted. The tin-bearing mineral cassiterite was identified as such by Richard Marsh of Spokane in the summer of 1906, but prospecting for tin was not begun until March, 1907. The first authentic account of this discovery published outside of the local newspapers was prepared by A. R. Whitman of Spokane and appeared in the MINING AND SCIENTIFIC PRESS of June 1, 1907, by which time several carloads of selected ore had been mined and piled on the dump.

The discovery derived additional interest from the fact that no tin ore had previously been reported from the State of Washington, and Arthur J. Collier, one of the geologists of the U. S. Geological Survey, was detailed to visit the locality and examine the conditions. Mr. Collier spent several days early in the season in going over the prospects, and again visited the region in October to note the developments made during the summer. The information gained as the result of these limited investigations is embodied in a paper just published by the Survey as an advance chapter from Bulletin No. 340.

The region about Spokane is rich in natural resources. The city itself, the most important of eastern Washington, is about 18 miles from the Idaho State line and 90 miles south of the Canadian boundary, on the lines of the Northern Pacific, Great Northern, and Union Pacific railroad systems, and is the centre for extensive agricultural, lumbering, and mining interests. Vast expanses of rich wheat lands in the Palouse and Big Bend countries lie to the south and west, great forests of valuable timber are within 100 miles to the east, and the mines of the Coeur d'Alene district, the chief producers of lead-silver ores, are within 100 miles to the southeast. The Spokane river has a fall of several hundred feet and furnishes the surrounding country with water-power. Several inter-urban railroads radiating from Spokane are operated with power from the falls.

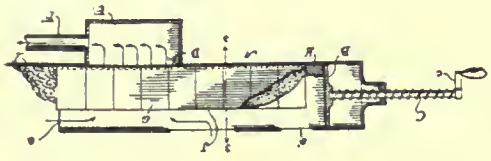
The geology of the Spokane region has not been studied in detail, but the relations of the rocks in the vicinity are known in a general way, and a brief statement of these relations is given by Mr. Collier. The rocks which seem to be the oldest in the region comprise a complex mass of gneisses and schists with many igneous intrusions of various kinds. These rocks form the mountains southeast of Spokane and contain the tin deposits.

The cassiterite found at Silver Hill is nearly black and is without definite crystal outlines. It is distributed through a nearly white, fine-grained rock, characterized by slight tinges of pink, in grains or masses ranging in size from that of a pinhead to that of a boulder several inches in diameter. Mr. Collier states that the developments at Silver Hill indicate that the tin ore is to be found in detached masses whose relations to each other cannot yet be determined.

MINING AND METALLURGICAL PATENTS.

Specially Reported for the MINING AND SCIENTIFIC PRESS.

PROCESS OF ROASTING AND SINTERING ORES.—No. 882,518. Arthur S. Dwight and Richard L. Lloyd, Cananea, Mexico.

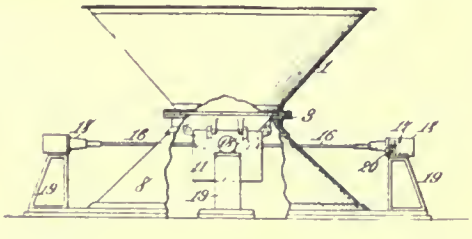


The herein described process of treating ores containing combustible elements to sinter them, which consists in moving a mass of the ore, firing it while being moved, beginning at the upper portions thereof, and subjecting the mass to a current of gas for supporting combustion, moving in a direction to cause combustion in the mass to progress in a downward direction, substantially as set forth.

PROCESS OF TREATING ORES.—No. 882,517. Arthur S. Dwight and Richard L. Lloyd, Cananea, Mexico.

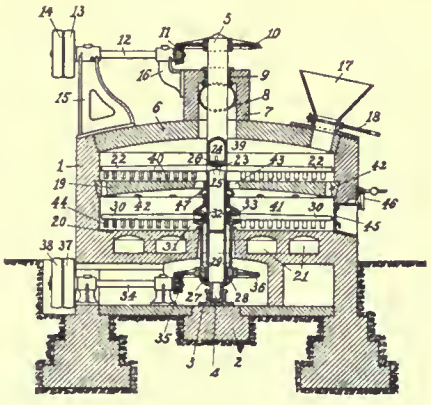
The process of treating metal-bearing ores in a mass of fine particles containing combustible elements and adapted to be sintered by internal combustion in the mass, which consists in igniting the combustible ingredients of the said ore, causing oxygen or a combustion supporting gas to pass to the interior of the mass of ore, thereby causing the combustion to extend from the place of initial igniting gradually into the interior of and through the mass, said mass having at all points substantially similar gas passages therethrough raising the temperature of the interior of the mass by such internal combustion to the point of sinter forming, and restraining from agitation or movement (in relation to the adjacent parts of the mass) those particles which are on the side where the gases or products of combustion escape until they have been sintered.

STOCK-DISTRIBUTER AND GAS-SEAL FOR METALLURGICAL FURNACES.—No. 883,044. Merrill B. Parker, Rockwood, Tennessee.



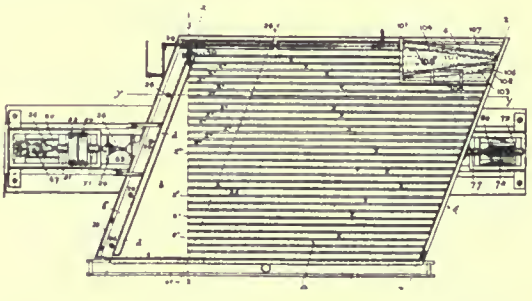
In a stock-distributor and gas-seal of the class specified, the combination with a receiving hopper and a furnace having a bell, of opposing pairs of doors hinged at their upper extremities to the lower portion of the hopper above the bell, and mechanism co-operating with the doors for either simultaneously moving the opposing pairs of doors inwardly at an angle of inclination, or opening one door of the pair and permitting the other to remain in inwardly inclined position, and also for alternately similarly actuating the opposing pairs of doors, the said mechanism including radially disposed straight piston rods rigid throughout their entire lengths, each piston rod being movably and directly attached to the outer side of one door below the upper hinged extremity of the latter, and fixed cylinders in alinement with the centers of the outer portions of the doors and having pistons therein to which the said piston rods are individually connected.

MECHANICAL ROASTING-FURNACE.—No. 882,730. Roman von Zelewski, Engis, Belgium.



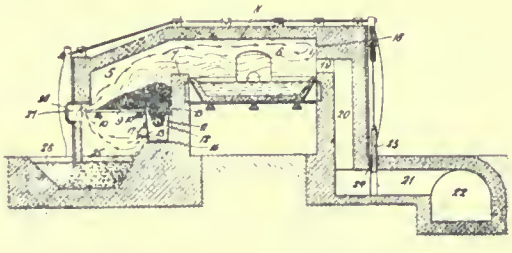
A mechanical roasting-furnace provided with a plurality of sets of rabbles, means for operating and for setting at rest one set of rabbles, and means for operating and for setting at rest another set of rabbles independently of the first-named set of rabbles.

ORE-CONCENTRATING TABLE.—No. 882,511. George E. Woodbury, San Francisco, California.



An ore concentrator having a concentrating table the surface of which has a riffled section, the riffles of which terminate on a line extending across the table and approximately at right angles to the lay of the riffles, and an unriffled or plain section beyond the riffles toward the discharge end of the table, this unriffled section being substantially triangular with its apex in close proximity to the uppermost riffles and its base coincident with the gangue discharge side of the table, the section being adapted to discharge concentrates along the whole of the concentrates end of the table, whereby the concentrates from the upper riffles are free to escape quickly after leaving the riffles, and those from successively lower riffles take gradually increasing paths of travel, and means arranged adjacent to the discharge edge of the table for feeding water to the said plane surface thereof.

FURNACE.—No. 883,057. Martin Van Buren Smith, New York, New York.



In a puddling furnace, the combination with a combustion chamber and means for evolving gases at a low temperature therein, of a puddling chamber adapted to receive gases thus evolved from the combustion chamber, means for supplying highly heated air from the combustion chamber to the puddling chamber in a condition substantially unmixed with the gases from the combustion chamber, and means within the puddling chamber to cause the mixture of the gas and air therein.

TUNGSTEN ORE PRICES IN GERMANY, 1902 TO 1908.

(Furnished by DeGolia & Atkins, San Francisco.)

The following table shows the approximate values of wolframite in Germany during the past few years. The price is given in dollars per unit of contained tungstic oxide (usually termed tungstic acid) per ton of 2000 lb., the unit being 1% or 20 lb. per short ton of 2000 lb. For instance, wolframite containing 60% (sixty units) tungstic acid would be worth $300 per ton when the price is $5 per unit.

Formerly scheelite was regarded as slightly less desirable than wolframite, and the price paid for scheelite has been from 50 to 75 cents per unit below that for wolframite. This difference arose from the fact that scheelite was considered more difficult to treat by the old crucible method of preparing tungsten; but for the modern method of reduction in the electric furnace scheelite is said to be fully as desirable as wolframite.

	1902	1903	1904	1905	1906	1907	1908
January		2.40	5.55 6.05	5.95	4.60 5.45	6.70 8.30	6.30
February		2.50	6.30	5.85 6.00	5.30 5.65	8.80 9.20	6.50
March		2.90	6.30	6.00	5.00 5.45	11.00	
April		3.35	6.30	5.60	5.05	10.90 11.55	
May		3.75	8.40	5.55	5.00 5.45	11.55	
June		4.20	7.85	5.25	5.70	11.10	
July		4.60	8.60	5.00	5.50	10.90 10.50	
August		4.60	9.20 10.05	4.20 4.40	5.85 5.95	10.50	
September	1.85	4 80	9.20	4.20 4.40	6.05	10.05 8.40	
October	2.10	5.25	9.20 7.55	3.75	5.75	8.40 7.10	
November	2.30	5.25	7.10	3.75	6.55 6.80	7.10 5.65	
December	2.30	5.25	6.05	3.75	7.00 7.55	5.65 5.00	

COMMERCIAL PARAGRAPHS.

N. D. Phelps has assumed the Pacific Coast management of the Power and Mining Machinery Co., Cudahy, Wis., and has established his office in 217 Sheldon Bdg., corner First and Market Streets, San Francisco.

The Tracy Engineering Co. of New York has secured the contract and started the construction of a 20-stamp combination amalgamating and concentrating mill for the Orange Blossom Mining & Milling Co., in southern California. This plant will be completed in 60 days.

Robert L. Bailie, president of the Golden Crest Mining Co., has placed a contract with the Moore Filter Co., and will shortly install at its mill in Deadwood, South Dakota, a Moore slime-filter having a capacity of 250 tons per day. The Moore process will be of their type 'A,' embodying many new features.

The Bristol Co., of Waterbury, Conn., has come under the control of William H. Bristol, whose inventions this company has been manufacturing since it was first organized in 1889. W. H. Bristol assumed active charge of the management of the business on March 28, and now owns the majority interest.

The Westinghouse Machine Co. announces that the receivers appointed Oct. 23, 1907, by the Circuit Court of the United States for the western district of Pennsylvania, were on March 31, 1908, discharged by the same authority. All of the matters which made a temporary receivership expedient have been satisfactorily arranged, and the company's position is greatly strengthened from every standpoint. All contracts made by the receivers for the sale of the company's product, or for the purchase of materials or merchandise, will be carried out as though made by the company's own officers. William H. Donner has been elected vice-president of the company, in direct responsible charge of all its activities.

BOOKS RECEIVED.

'Metallurgy of Tin.' By P. J. Thibault. Pitman & Sons, London. 250 pp. Price $4. This book is full of valuable information on all branches of the metallurgy of tin, especially as practised in Australia. The methods of assaying tin ores and furnace products are described, and also the methods of working placer deposits by dredging and sluicing. The reduction of ore is also described in detail. Much interesting and valuable information is obscured by the inferior printing of the reading matter and illustrations, while the poor presentation of the material makes it an unpalatable segregation of metallurgical statements rather than the lucid treatise which the author might have prepared. For sale by the Mining and Scientific Press.

'The Standard Handbook for Electrical Engineers.' McGraw Publishing Co. 1283 pp. Price, $4. This is the most complete handbook for electrical engineers that has been published. The entire field has been treated, in 20 sections, each of which was assigned to a specialist. The book is well indexed, and the numerous references to technical literature and excellent material make this a most valuable book of reference, which should be in the office of everyone actively engaged in electrical engineering practice. For sale by the Mining and Scientific Press.

'Lead Refining by Electrolysis.' By Anson Gardner Betts. 394 pp. $4. J. Wiley & Son. For sale by the Mining and Scientific Press. This book contains information resulting from years of study, experiment, and practical work of the electrolytic refining of lead bullion, which is now an established metallurgical process and one from which further developments may be expected in the future. The methods of slime treatment are also discussed in considerable detail.

'Simple Mine Accounting.' By David Wallace. 64 pp. $1. Published by the Hill Publishing Co. For sale by the Mining and Scientific Press. This book is intended for those who have had no chance to learn book-keeping. It is well adapted for the use of foremen and superintendents, being sensible and simple. It covers the ground satisfactorily, from vouchers, cash-books, and ledgers to stock and smelter records.

'Methods and Devices for Bacterial Treatment of Sewage.' By W. M. Venables. 236 pp. $3. J. Wiley & Sons. For sale by the Mining and Scientific Press. This subject is fully treated from the view-point of the civil engineer, and contains a full summary of the known engineering principles involved in the subject under treatment and a statement of the problems unsolved.

'The Engineering Index Annual' for 1907. Published by *The Engineering Magazine*. This is the sixth volume of an index now well known to technical men. Each branch of current engineering literature is classified, so that an individual article is easily found. Price $2.

CATALOGUES RECEIVED.

Beaudry & Co. have issued a booklet describing the Beaudry Champion power-hammer.

The Stromberg-Carlson Telephone Mfg. Co. has issued pamphlet No. 5, describing its Iron Clad Magneto telephone.

L. Vogelstein & Co. give the following figures of German consumption of foreign copper for the months of January and February, 1908:

	Tons.
Imports of copper	29,817
Exports " "	1,413
Consumption of copper	28,404

as compared with consumption during the same period in 1907 of 16,044 tons. Of the above quantity, 21,910 tons were imported from the United States.

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Editorial.

OUR CONTEMPORARY at New York, *The Engineering and Mining Journal*, issues an excellent supplement devoted to the coal industry. The *Journal* is the recognized weekly authority on this subject.

IT IS ANNOUNCED that there will be a Mining Exposition in Madison Square Garden, New York, from May 25 to June 20. The United States Government and many of the States will participate by sending exhibits of their mineral resources.

BY TELEGRAM, we learn that the Mining and Metallurgical Society of America was organized at a meeting held on April 20 at New York. There is to be another meeting on the 27th instant. In our next issue we shall publish the constitution and by-laws.

WE ARE GLAD to state that Dr. T. Kirke Rose and Mr. H. Forbes Julian have become Special Contributors to this journal. These two distinguished metallurgists need no introduction to our readers. Dr. Rose's 'Metallurgy of Gold' and Mr. Julian's collaboration with Mr. Edgar Smart in 'Cyaniding Gold and Silver Ores' have made their names honored throughout the world of mining. Only recently our list of Special Contributors was strengthened by the addition of Messrs. Horace V. Winchell and John A. Reid, two geologists of recognized standing. The editor of the MINING AND SCIENTIFIC PRESS is proud to have the support of these leaders in the profession.

NAT C. GOODWIN said recently in a speech that he had "decided to go into the realm of minery." He should have said, not minery, but spoofery. It is a wide realm, with uncharted shores, dangerous reefs, tricky shallows, and lots of terrible pirates that scruple at nothing. And woe to the poor actor that wanders therein. Not that Mr. Goodwin is a bad actor; in that respect he is well enough, but in mining affairs he is either a knave or a fool. He has no right to allow his name to be placed at the head of a mining company, for in such matters he is wholly ignorant and the use of his notoriety as an actor in order to help the sale of stock is obviously to lure simple people into investing their money in ill-advised schemes.

RESORT TO a spiral tunnel by the Canadian Pacific railway to reduce the heavy grade on the main line up Kicking Horse canyon in British Columbia, announced in our correspondence from Rossland this week, recalls the fact that the originator

of this clever plan for overcoming the obstacles to railroad mountain-climbing was the late Mr. William H. Cilley, an American engineer. After long and costly efforts to find a way for the Peruvian Central railway on a feasible grade up the valley of the Rimac, the solution of the problem came as a flash of genius. Mr. Cilley turned into the mountain, lengthened the road by a spiral tunnel, and reduced the grade. The method was later applied for a like object in the St. Gothard tunnel in the Alps.

NEW DISCOVERIES are being made almost daily in Nevada, and while some of them may be ephemeral, others will probably prove the basis for important mining enterprises. We hear good news of Seven Troughs, Fairview, Jamestown, Jessup, Hornsilver, and Stimler, besides the overboomed camps of Round Mountain, Manhattan, and Rawhide. At Goldfield, the discovery in the Big Bend is important because it is three miles northeast from the bonanza zone and thus indicates an extension of the productive territory. At Rawhide there are 15 hoists at work and that means mining, which is more likely to uncover orebodies than the twaddle of actors and stockjobbers.

THE SEPARATION OF SLIME has always been a bug-bear in ore-milling. It has become one of the great problems in the way of the metallurgist since the cyanide process has attained such universal application. Aside from any emoluments it may bring, it is an honor to contribute effectively toward the solution of this vexing difficulty, and it appears that Mr. Horace G. Nichols has won claim to high consideration for his brilliant discovery, described in our columns elsewhere. So radical is the new fact here presented concerning the fall of matter suspended in water, that it has been asserted by Mr. R. Gilman Brown that "all facts and data in relation to the settlement of slimes might have to be reconsidered in view of the admissibility of the factor of retardation and the possibility of its removal" in the way pointed out by Mr. Nichols. The principle now for the first time recognized, has been utilized in several ways before, but never in so effective a manner, because the significant fact was not then understood. To Mr. Nichols came the inspiration of the interpreter, and the opening up of most important practical possibilities follow.

LABOR conditions on Douglas island, which is synonymous with the Alaska Treadwell mine, are improving. The town, immediately west of the mines, has held an election and this resulted in the victory of the 'town' ticket over the 'labor' ticket. The *Daily Alaska Despatch* congratulates its readers on their success in keeping municipal affairs free from labor strife. We second that. The Western Federation of Miners has been pursuing a dog-in-the-manger policy, unwilling to work themselves, and yet anxious to prevent others from accepting a job at Treadwell, where high wages are paid, where the mines are dry and safe, and where the employees are better fed, housed, and treated than almost anywhere in America.

Yukon Gold.

AT THE TIME of Mr. Lawson's advertising campaign we stated that a criticism of the technical features of this important undertaking would be postponed until the full reports of the engineers were available. This was only fair. If mining engineers cannot get fair criticism in the editorial columns of a professional paper, where then will they get it? Certainly not in the daily press, steeped in ignorance of technical matters, nor in the financial periodicals subventioned by various promoting agencies. Since we referred to the Yukon affair, we have received a letter from Mr. O. B. Perry, who is the chief engineer of the enterprise, for Mr. A. C. Beatty only confirms his colleague in a general way, not having data of his own wherewith to base a separate judgment, and as regards Mr. A. N. C. Treadgold, he performs the function of an enthusiastic promoter rather than that of a technical adviser. Mr. Perry's letter, appearing on another page, is welcomed, but the main purpose of it seems to be to combat the notion that "the properties have no value" and to emphasize the fact that a good deal of preliminary work and careful investigation have been performed at Dawson in behalf of the Guggenheims. Of this there never was any doubt in our mind, nor in that of others at all well informed, for Mr. Perry himself has an excellent reputation in San Francisco, and it was assumed that he would not incur so grave a responsibility without much forethought. The question is not as between worth or worthlessness of the Yukon enterprise but concerning the earning capacity of the heavily capitalized company that has been formed to exploit these gravel deposits. We do not ask whether the mining operations will be profitable, but whether they can repay the capital, and a reasonable interest, of a corporation organized with 3,500,000 shares of $5 each. Then we ask what return there will be on the $7.50 to $15 variously stated by Mr. Lawson to be the present worth of the stock placed on the market by that financial filibuster. But at this point we think it well to halt and enquire what responsibility is to be attached to the engineers as regards the issuance of the stock recently advertised in a campaign of misstatement. Mr. Beatty is so closely identified with the business dealings of the Guggenheims that he is likely to have known what was about to happen. If he did not we hope he will say so, if only to remove a blemish from his reputation for shrewdness in business affairs. His report in the printed statement now issued is no report at all, but a blank check to Mr. Perry, on whom professionally the entire responsibility rests; for, we repeat, Mr. Treadgold is to be classed as the promoter who originated the scheme, rather than an engineer qualified to pass an opinion upon it. As to Mr. Perry, we believe that he has been placed in a false position. Until the morning when he saw Lawson's flamboyant advertisements in the daily papers, he knew nothing of the scheme

to sell stock at an inflated price. This information does not emanate from him: as an engineer his first duty was to be loyal and we know enough of such matters to be able to emphasize the paramount obligation of a professional man to consider the interest of his client even at the hazard of his own reputation. But we decline to blame Mr. Perry in any way for the antics of Lawson or for the misuse made of his report. It is a sad fact that the mere mention of a man's name by Lawson in any of his pronunciamentos is damaging; if S. F. Emmons or James D. Hague were quoted by Lawson in one of his broadsides, the mere association would depress the character-stock of men of even such unquestioned reputation. Lawson is a pest.

From the report we are led to conclude that the enterprise was in no condition for presentation to the public and that the statements of Messrs. Beatty, Perry, and Treadgold, although dated on different days of the past month, were prepared in a hurry. Mr. Perry says that the "partial equipment" will be "practically completed" by the end of 1909, and it will not be until 1910 that operations at Dawson will be in full swing. According to Lawson's advertisement, Mr. Beatty appears to contradict Mr. Perry by saying that "the properties are fully equipped," but by referring to the printed report it is seen that Mr. Beatty said "*when* the properties are fully equipped." The re-arrangement of the paragraph indicates that this is no mere typographical error, but a willful misquotation. There is nothing in Mr. Perry's report that can be construed as an endorsement of the valuation placed upon the property by Lawson. In that report the gravel available for profitable mining is estimated as containing $50,000,000, from which a profit of $36,000,000 is to be won, and in default of a statement by Mr. Perry as to the total quantity of gravel we turn to Mr. Treadgold and find his estimate to be 137,000,000 yards, from which we get a working cost of 10 cents per yard. Turning to Mr. Perry's letter, appearing in this issue, we find that his total estimate is for 109,450,000 yards, having a gross value of $47,850,000 and a net profit of $37,500,000, so that here again the logical inference points to a cost of 10 cents per cubic yard. But this does not agree with the expressed statement that the cost of working is to range from 10 cents when hydraulicking the hill deposits to 32 cents when dredging the creek bottom. From these grand totals and general estimates we turn to the plain statement of Mr. Perry (in the printed report) that the Yukon Gold property contains 30,000,000 yards of creek gravel, containing $20,800,000, to be worked for $9,000,000, which is equivalent to a cost of 30 cents and a profit of 39 cents per yard. Then there are 35,000,000 yards of hill gravel, containing $11,250,000, to be extracted for $3,500,000, or a cost of 10 cents and a profit of 22 cents per yard. Thus we have 65,000,000 yards from which a profit of something over $19,000,000 is to be won. So far so good. Next come "probabilities and possibilities": these include 20,000,000 yards in the creek and 10,000,000 yards on the hill. In some way, partly explained but by no means clear, the total gross value climbs to about $50,000,000 and the estimated profit to $38,000,000. If Mr. Treadgold's figures are included, as stated in the printed prospectus, the confusion becomes intensified, for he speaks of 137,000,000 yards assured and a further probable 21,000,000, to be treated "at a later stage," and even this grand total of 158,000,000 does *not* include the Cariboo and Atlin properties, the yield of which *is* included in Mr. Perry's estimated profit of $38,000,000. All this shows that insufficient exact information is available at this time. A yardage that ranges from 95 to 158 millions, and a profit variously estimated at from $37,500,000 to $46,450,000, suggest that there are undetermined factors in the problem. Mr. Beatty endorses Mr. Perry's report, Mr. Perry believes Mr. Treadgold to be a "keen and careful observer," and yet the net result of their investigations is a mass of contradictory figures. The plain fact appears to be that exact data are not available at this time. A great deal of useful work and intelligent investigation have been in progress under the direction of Mr. Perry and he has done much toward solving the difficult problems presented by arctic conditions. He is deserving of credit for having devised new methods for overcoming the hindrances to cheap operation in frozen ground, and had he been given further time he could have made a report that would have hung together. It appears to be another case of an engineer's reputation being endangered by the exigencies of finance.

From this maze of conflicting figures we return to the plain statement that the Yukon property contains, assured and proved, 65 million yards capable of yielding a profit of 19 million dollars. In 1908 the profit is to be $800,000; in 1909 it is to be $1,500,000, leaving $16,700,000 still to be won. By 1910 the operations are to be in full swing and will yield a profit of about $2,500,000 for "a number of years to come." At this rate the $16,700,000 will have been realized in 7 years. Thus Mr. Perry suggests 9 years as the term wherein the assured resources will be exhausted. Anyone investing $17,500,000 (the capital of the Yukon Gold Company at $5 for 3,500,000 shares) today, in safe 5½% bonds, would receive in 9 years, with interest compounded, the sum of $28,332,500. Those who get 19 millions from the golden gravel at Dawson will receive each year a sum of money ranging from $800,000 at the end of 1908 and $1,500,000 at the end of 1909, to $2,500,000 thereafter for 7 years more. These annual profits if re-invested at 5½%, would yield $4,000,000 in the 9 years, and this added to the $19,000,000 makes $23,000,000, which is about $5,000,000 less than the sure gain accruing from the investment of $17,500,000, as above explained. Thus the investor pays $5,000,000 for the "probabilities and possibilities," which will not be forthcoming in the first nine years but may become a feature at a later stage. And we are quite ready to accept Mr. Perry's professional opinion that those "probabilities and possibilities" are worth $5,000,000 more than the money paid for the certainties. Therein lies the sport of mining, and also the great gains made by the adventurous. But not on a basis of twice what the property cost. According

to the published report of the Guggenheim Exploration Company there has been invested in the Yukon properties, and their equipment, the sum of $8,220,000. This was done on Mr. Perry's advice and he validates that advice when he states to Mr. Daniel Guggenheim that there is $19,000,000 assured, to be extracted in 9 years, with "probabilities and possibilities" that are problematical and uncertain, of course, but yet capable of doubling the final return of money. On an investment of 8 millions to return 19 millions in 9 years, Mr. Perry gave the Guggenheims an investment yielding 20.2%, not to mention the aforesaid "probabilities and possibilities." Mr. Perry is a good adviser to his clients, but that same advice when twisted and distorted by the hand of Lawson becomes illogical and unconvincing to the point of absurdity. On Mr. Perry's advice the Guggenheims invested 8 millions on the Yukon, then the Guggenheims capitalized the enterprise for 17½ millions, and finally Lawson shrieks that it is worth anyway from $26,250,000 to $52,500,000. Perry ascertained the actualities, the Guggenheims capitalized the possibilities, and Lawson distributed the eventualities.

JUST as we go to press, the editor is in receipt of the following telegram from Mr. O. B. Perry:

"Find on investigation that table prepared in my absence to accompany my letter reference Yukon, was compiled from a cancelled report and that figures are absolutely incorrect and worthless for purpose intended. Please destroy table and take any figures you care to use from the printed report. Regret mistake, which was due to my enforced absence from office account sickness." This is dated April 23, at New York. In order that no injustice may be done, this telegram is given the fullest publicity, but, as a matter of fact, it will be found that our comments have little to say concerning the table which was transmitted in error. Mr. Perry's letter, which appears under 'Discussion,' was in print before his telegram arrived and it was impossible to comply with his request. Unfortunately, the letter itself does not refer to the table in such a way as to identify it or to suggest the error in transmission.

The Engineer and the Economic Geologist.

BROAD scientific generalizations are always useful when they emanate from men who have helped to build up science, who know the inner framework of the structure, and the character of the foundation on which it rests. They enable the learner to avoid errors and loss of time, and to fix attention upon the points that need elucidation. Just such a helpful and stimulating document is the recent presidential address of Mr. Waldemar Lindgren, before the Geological Society of Washington, the major portion of which we re-print in this issue. Mr. Lindgren speaks by authority of rich experience in the detailed study of the greatest mineral districts of two continents. He has helped unravel their geologic story, and he has been one of the foremost men of the time in interpreting the phenomena of ore genesis. Mr. Lindgren's conclusions carry the greater weight because of his freedom from radical views. The enthusiasm of the deductive scientific speculator is excellent, chiefly because stimulating. It may also lead to a short-cut in reaching a comprehension of things that might otherwise have remained long hidden. But the inductive reasoner is the safe guide, and such is Mr. Lindgren in the great field of economic geology. The degree of caution, in the light of wide first-hand acquaintance with facts, displayed by his attitude toward classifications of ore deposits, challenges attention. When geologists knew less they were fruitful of elaborate schemes of classification. The text-books have been full of them. But our knowledge of geochemistry, of metamorphism with its startling physical as well as chemical influences, of magmatic differentiation, and of other conditions beset with difficulty for the collector of data, has so grown, and so complicated our view, that we find Mr. Lindgren siding with those who will not attempt to make final subdivision beyond the classing of all deposits as either syngenetic or epigenetic, that is, those formed contemporaneously with the enclosing rocks, and those introduced subsequently. This relieves the student from embarrassment, for the tendency of the young geologist is to fix his facts each in some proper category, and the wider his main sub-divisions the more free and open to revision do his data remain.

We think Mr. Lindgren expresses a professional bias, however, which has been a product of unconscious growth among economic geologists, following the enormous expansion of the subject in recent years. Economic geology has not become a department of science, but a kindly link between the plain geologist on the one hand, whose concerns are chiefly with physics and chemistry, paleontology and stratigraphy, and volcanology, and the engineer and industrial worker on the other hand, whose concerns are to obtain as quickly and cheaply as possible a maximum quantity of useful metallic wealth for the benefit of the world. It is not just to a profession which demands such varied training in high degree as that required by mining engineers to insinuate that its members are merely blessed "with sufficient geological training to appreciate and describe what they see." The work of men like Rossiter W. Raymond, Clarence King, James D. Hague, and a goodly company of younger men whose contributions have appeared in the *Transactions* of the American Institute of Mining Engineers and elsewhere, has been far more than descriptive—it has been constructive in the best sense. Cleavage between the mining engineer and the economic geologist should not in fact be drawn. They should recognize themselves to be of one fraternity, in the interests of efficient co-operation as specialists within the same profession. We believe it not unjust to assert that the references made by officers of the Geological Survey and other professional geologists, to the investigations carried out by mining engineers, have occasionally been lacking in the generosity that marks great scientific men. Volunteers are as patriotic as regulars, and occasionally as good soldiers.

Personal.

JAMES D. HAGUE is here.

J. R. FINLAY is at Joplin.

J. H. CURLE is in Bolivia.

NEWTON B. KNOX is at Paris.

J. W. MERCER is at Mexico City.

H. C. HOOVER is about to go to Singapore.

MARK L. REQUA is on his way to New York.

LEWIS T. WRIGHT has returned from London.

F. J. SIEBERT, of Goldfield, was here this week.

ALLEN H. ROGERS, of New York, is now in Mexico.

F. H. MOBLEY, of Denver, is now in Sonora, Mexico.

A. J. BENSUSAN has returned to London from Brazil.

EDMUND JUSSEN, of Salt Lake, is visiting Blair, Nevada.

F. L. RANSOME was in New York for a couple of weeks.

H. W. TURNER has been examining the Monterey coal mines.

R. B. WILLIAMS is with the Miami Copper Co. at Globe, Arizona.

FRANK H. PROBERT has returned to Los Angeles from Globe, Arizona.

W. J. LORING arrived in San Francisco and then went on a visit to Angels.

ERNEST H. DENICKE has returned to San Francisco from southern Nevada.

JOHN H. MARKS has returned to Denver from the Altar district, in northern Mexico.

F. W. OLDFIELD of Los Angeles was in San Francisco on April 20, on his way to Vancouver.

W. F. HARRISON has been appointed manager for the Indé Gold Mining Co. in Durango, Mexico.

J. W. BRYANT, superintendent for the Tyee Copper Co., has returned to Victoria from Mexico.

WALDEMAR LINDGREN was in San Francisco and has gone to inspect some new Nevada goldfields.

ROY H. CLARKE has removed his office from the Columbia building to the Hyde block, at Spokane.

JOHN W. FINCH is traveling in Switzerland and Italy. In July he will open an office in New York.

H. GRAFTON VERCOE, son of the late H. B. VERCOE, is now living at Camborne, in Cornwall, England.

OLIVER B. FINN, of Colorado Springs, is now at Tucson, Arizona, where he is examining some copper mines.

G. McM. ROSS has just returned to San Francisco from Nevada, where he has been examining several mines.

W. H. KNOWLES, formerly in Colorado, now residing at Los Angeles, is examining mines near Phoenix, Arizona.

A. P. ROOT and LUCIEN H. NORTON have formed a partnership and opened an assay laboratory at Silverton, Colorado.

D. M. MUNRO has been appointed manager of the El Favor mine in the Hostotipaquillo district, State of Jalisco, Mexico.

LLOYD WOMBLE has joined the staff of Chas. Butters & Co. and sails from San Francisco on April 25 for Devisadero, Salvador.

CONTE DE TRISTAN, mining engineer to the Staffer Chemical Co., has been visiting the Summit mine, in Shasta county, California.

H. FOSTER BAIN, H. V. WINCHELL, and GEORGE H. ASHLEY have become associate editors of *Economic Geology* with JOHN D. IRVING, the editor.

The firm of PEMBROKE & RIGBY, of Salt Lake, has dissolved, and EARL R. PEMBROKE has established an office at 54 W. 2nd St., Salt Lake City.

BULKLEY WELLS was in San Francisco on his way to southern California. He is still suffering from the shock to his system caused by the explosion.

A. N. CLARK, formerly of the editorial staff of the *Engineering News*, has been appointed superintendent for the Arizona-Nevada Gold Mining Co., near Luning, Nevada.

Latest Market Reports.

LOCAL METAL PRICES—Apr. 23.

Antimony	12@16c	Quicksilver (flask)	$45@45.50
Casting Copper	14¼@15¼c	Spelter	6½@ 7¼c
Pig Lead	4.35@ 5.30c	Tin	32½@34c

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date	Electrolytic Copper	Lead	Spelter	Silver
Apr. 10	12.81	3.95	4.63	54½
" 11	12.81	3.98	4.63	54½
" 12	Sunday. No market.			
" 13	12.68	3.98	4.63	54⅜
" 14	12.68	3.98	4.63	54¼
" 15	12.68	3.98	4.63	55
" 16	12.68	3.98	4.63	54⅞
" 17	12.69	3.99	4.64	54⅞
" 18	12.69	3.99	4.64	54⅞
" 19	Sunday. No market.			
" 20	12.69	3.99	4.64	54⅞
" 21	12.69	4.00	4.64	54⅝
" 22	12.69	4.00	4.64	54⅜
" 23	12.69	4.00	4.64	54⅜

ANGLO-AMERICAN SHARES.

Cabled from London.

	Apr. 16. £. s. d.	Apr. 23. £. s. d.
Camp Bird	0 14 0	0 14 0
El Oro	1 3 0	1 4 3
Esperanza	1 8 0	1 7 6
Dolores	1 5 0	1 5 0
Oroville Dredging	0 12 0	0 12 3
Stratton's Independence	0 3 0	0 3 0
Tomboy	1 11 3	1 11 3

(By courtesy of W. P. Bonbright & Co., 24 Broad St., New York.)

MINING STOCK QUOTATIONS—NEW YORK.

	Closing prices. Apr. 16.	Apr. 23.
Bingham Central	½	½
Boston Copper	11⅝	11½
Cumberland Ely	7⅞	7⅞
El Rayo	1¾	1¾
Giroux Con.	3½	3½
Guanajuato Con	....	2
Nevada Con	11¼	11⅛
Nipissing	6⅝	6⅞
Tennessee Copper	40½	37¼
United Copper	6½	6¼
Utah Copper	30	29⅝

(By courtesy of Hayden, Stone & Co., 25 Broad St., New York.)

SOUTHERN NEVADA STOCKS.

San Francisco, Apr. 23.

Atlanta	$ 25	Manhattan Con	14
Belmont	1.17½	Midway	60
Columbia Mtn	21	Mizpah Extension	3
Combination Fraction	65	Mohawk	.....
Daisy	1.15	Montana Tonopah	1.75
Fairview Eagle	40	Nevada Hills	2.45
Florence	3.92½	Rawhide Queen	22
Gold Bar (Bullfrog)	18	Red Top	.....
Goldfield Con	5.42½	Sandstorm	36
Gold Kewanas	37	Silver Pick	20
Great Bend	44	St. Ives	33
Jim Butler	32	Tonopah Extension	1.25
Jumbo	.....	Tonopah of Nevada	8.37½
Jumbo Extension	31	Tramp Con	22
Laguna	95	West End	45

(By courtesy of W. C. Ralston, 353 Bush St.)

COPPER SHARES—BOSTON.

	Closing prices. Apr. 23.		Closing prices. Apr. 23.
Adventure	1½	Michigan	10½
Ahmeek	60	Mohawk	47
Allouez	24	Nevada Con	11¼
Amalgamated	58¾	North Butte	53½
Arcadian	8½	Old Dominion	33½
Atlantic	8¼	Osceola	81
Bingham Con	50	Parrot	18⅜
Boston Con	11½	Phœnix	50
Butte Coalition	20⅞	Quincy	82
Calumet & Arizona	100	Rhode Island	2½
Calumet & Hecla	625	Santa Fe	1⅝
Centennial	21	Shannon	11⅜
Con. Mercur	40	Superior & Pittsburg	11⅞
Copper Range	65½	Tamarack	59
Daly-West	8¼	Trinity	14½
Franklin	6½	United Copper com	6½
Granby	90	Utah Copper	.....
Greene-Cananea, ctf	8	Victoria	2¾
Isle Royale	19	Winona	4⅞
Mass	2¾	Wolverine	125

General Mining News.

ALASKA.

(Special Correspondence).—Nolan creek, a tributary of the Koyukuk river, has been developed this winter, and very rich diggings have been found. Nolan and Murray have found a pot-hole on their Discovery claim which is stated to have produced $128,000. The bedrock is 100 ft. deep in places and large nuggets occur.——Good pay gravel has been found on Smith and Vermont creeks and all the tributaries of the Hammond river. Nolan creek is 60 miles from the Chandelar.——A new pay-streak has been found two miles west of Nome. It is about 35 ft. below sea level and crosses the present shore line. It was discovered by J. Brower and occurs in frozen ground that extends under the Bering Sea. The strike at Fairbanks still continues and the operators are importing non-union laborers. Soldiers have been ordered from Fort Gibbon to the Tanana. ——Several business men are leaving Nome to go to Anadyr, Siberia, where a stampede will probably soon occur. A line of steamers will be put on this summer from Seattle, calling at Nome. Rich quartz and placer deposits are reported. The Governor of that district in Siberia has given a warning that no person will be allowed to land who has not provisions for one year, or its equivalent, that is, about $300 or 700 roubles. The steamer Corwin from Seattle is already announced to leave Nome about June 15 for Anadyr. ——At Nome work is actively progressing. Fifteen steam hoists are operating on Center creek, and 47 other hoists are working adjacent districts. Over 100 claims are taking out pay-gravel and the snow is deep and the prospects for plenty of water during the summer are excellent.——It is stated that a rich gold discovery has been made on the Innoko river adjacent to the Kuskokwim district. To go to this district prospectors go 400 miles up the Yukon to Yukon slough. This is followed 40 miles to the mouth of the Innoko river. From the mouth to the Indian village of Diskakat is 150 miles by water or 75 miles by winter trail. This is the head of navigation for boats over 20 tons. The diggings are about 125 miles farther up. A new route will soon be opened, leaving the Yukon 155 miles south of Fort Gibbon. From this point a trail is being cut, which will reduce the distance to 100 miles from the Yukon river to Innoko.

Nome, March 15.

ARIZONA.

COCHISE COUNTY.

The new power-house and hoist at the Copper Queen is nearly finished.——At the Calumet & Arizona smelter the construction work on the enlargement of the plant is making good progress. The frame for a new converter has been completed and excavations are now being made for moving the four converter stacks in operation at this time from their present position to the south side of the smelter building. When the converters are moved they will be connected with the new smokestack already completed. Then the work on the new furnace can be started, as the material has already arrived. During the last year the C. & A. has done a large amount of construction work at their new plant, including a new power-house, a new machine shop and a new blacksmith shop. In the new power-house all the machinery which will be required for the enlarged plant is in place, with the exception of a blower engine for the No. 7 furnace. The old wooden ore-bins are now being torn away so that the new blast-pipes can be placed in position. The old bins have not been used except for storing surplus ore since the high line was constructed more than a year ago. During the present week there has been an increased quantity of coke coming in from the ovens. This coke has been piled along the side-tracks, where it will be picked up by the steam shovel when required for the furnaces. The C. & A. has never carried a large amount of surplus ore, but at the present time more ore is coming from the mines at Bisbee than can be handled in the furnaces, so that the surplus piles are growing larger. Five furnaces are being run to the limit of their capacity, which is 300 tons each. When the present plans of enlargement have been completed the C. & A. smelter will have a capacity of more than 3000 tons daily.——The Great Western group of claims, a few miles from Gleason, has been bonded by T. W. Young, and development work has been begun.

GILA COUNTY.

Ore has been found in the north cross-cut on the 12th level of the Gem mine of the Globe Con. Co. at about 750 ft. from the shaft. The development of the vein at this depth will determine the future of the mine.

MOHAVE COUNTY.

(Special Correspondence).—The Gold Bug mine, which up to a few years ago produced considerable gold ore of a shipping grade, and was then abandoned until recently, is being overhauled for work again. There are over 250 ft. of underground workings from the 300-ft. level, which have caved badly, filling up the drifts with impassable piles of débris, which are being removed, and the work of timbering up the main shaft is also under way. The mine is situated in the White Hills district, about 30 miles north of Chloride, the terminus of the Utah branch of the Santa Fe Pacific railroad, whence timbers are now being hauled by wagon to the mine. The work of cleaning out the old workings will require about 60 days, when the work of sinking the shaft to a depth of several hundred feet below its present level will begin.——The group of mining claims belonging to Buchanan and Chittenden, situated five miles south of Kingman, at the edge of the Malapai belt, has passed into new ownership. A. L. Darbyshire is the purchaser. The claims are known as the Abe Lincoln group, and is in easy hauling distance to McConico station on the Santa Fe Pacific railroad. An agreement was made as one of the terms of the sale that a shaft would be sunk to a depth of 200 ft. at once. A company will be floated to raise capital to carry out the plan of development, but A. L. Darbyshire will arrange for commencement of work before leaving for the East.——Arrivals here from the Gold Road mine in San Francisco district report the opening up of a good shoot of ore. The new find was made on the 500-ft. level, where a body of high-grade milling ore was encountered and the work of opening up new stoping ground immediately began. ——San Francisco capitalists have a mining engineer examining the Sheeptrail mine in the Union Pass district with a view to purchasing. The claims in this group have veins which are large but of low grade. The Catherine claim, which lies 6 miles west of the mine, at one time produced considerable gold and silver. All the old workings in both camps are in a good state of preservation.——A fine showing of ore was made last week in the Tyro group of mines in the Signal district, samples of the new ore running more than 50 oz. silver per ton. The discovery was made in a new shaft being sunk on the north end of the group and was the first silver ore found.——Work is being systematically continued on the 500-ft. shaft of the Victor mine two miles west of Gold Road.——A 30-ft. vein of ore, running $10 in gold and silver, is being worked on a claim situated in the south end of the Wallapai mountains, about 20 miles east of Kingman. The property belongs to W. Brown, S. Settle, and F. Brown, who are endeavoring to procure means to install reduction works and develop the property.

Phoenix, April 18.

YUMA COUNTY.

The Colonial Mining Co. has started smelting at its mine 12 miles north of Quartzsite. The new furnace is of 30 tons capacity. The shaft is being sunk from 500 to 1000 ft. and rich cinnabar ore has been developed. A new rock-breaker has been put up. C. Dennis is superintendent.

CALIFORNIA.

CALAVERAS COUNTY.

The Melones Mining Co. resumed work on March 1, on the basis of leaving the collar of the shaft or adit at 7 a. m. and working until 4:30 p. m., with 30-min. interval for lunch. At the surface, the shift is 10 hr., with 30 min. for

lunch, except machine-tenders, who work 11 hr. F. Langford is superintendent.

EL DORADO COUNTY.

At the Martin mine in the Grizzly Flat district, the shaft has reached a depth of 50 ft., but sinking has been discontinued owing to an excessive flow of water. A drift is now being driven to the north and about 150 tons of ore have been extracted for a test run, which will soon be made at the Mount Pleasant mill.——Development work is progressing well at the Prevolcanic mine at Pacific, and a good gravel channel has been found.——The Gold Hill mine has been sold to T. H. & N. Douglas. A large quantity of low-grade ore is on the dump. A mill will soon be erected.——A two-stamp mill is being put up at a quartz mine near the Alpine. The mine is leased by Gray and Coster, and a shaft sunk 50 ft. has encountered a shoot of rich ore.——A find of rich ore has been made in the Martin mine near Grizzly Flat.——A test run is being made with the five-stamp mill on a body of ore recently found in the Stillwagon mine.——A body of rich gravel has been found in the Gignac mine at Texas Hill. The ore has been tested by a mill run, and the mill will now be moved to a more convenient position.

NEVADA COUNTY.

(Special Correspondence).—Good ore has been opened up in the winzes at the Pennsylvania mine. The vein is strong and of good grade. The mill is running steadily. Bennett Opie is superintendent.——At the Gold Mound a 6-ft. vein is being developed by a drift from the bottom of the shaft. The ore is a good milling grade with occasional rich bunches. H. P. Dennis is superintendent.——Limited developments are under way at the Aurura. Sinking will be resumed in the near future. Harry Skewes is superintendent.——Preparations are being made to commence work on the Sunflower mine during the coming summer.——Extensive development work is going on at the Kenosha. The shaft is going down steadily. Good ore has been blocked out on the 300 level.——Three shifts are sinking the shaft at the Murchie mine from the 1000 level. The men recently employed in the work demanded $3.25 per day and were at once discharged. A new crew was put to work on the old scale, $3 per day. Labor is plentiful and the company is in a position to obtain all the men needed.——James A. Fly and associates have bonded the Marcotte mine and intend to work it on a comprehensive scale. The new five-stamp mill is running steadily.——Martin Vanberg has located the West Arctic claim in the Washington district.——The lower adit at the Plumbago mine will be extended to a distance of 5000 ft. It is now in about 3000 ft. Heavier machinery will be installed at the property.——At the Champion the new winze-shaft is going down steadily. In the lower workings considerable ore is being developed.——A large force is working at the Mountaineer and good ore is being developed.——The Golden Gate mine is working with a small crew.——At the Sultana group all the work is being carried on through the Presscott Hill shaft. Extensive orebodies have been developed and the property is looking well.——At the Yuba mine, near Maybert, arrangements are being made to operate the property on a large scale during the coming summer. The working force will be largely augmented and developments energetically pushed.——It is reported that the Giant King mine will be worked extensively during the summer.——The coal deposits in the eastern end of the county are attracting attention. A Nevada company was recently organized to prospect the district.

Grass Valley, April 20.

Good milling ore is being extracted from the Gold Mound mine on Deadman's Flat. The vein is about 6 ft. wide and of good milling grade.——Development work will soon be resumed at the Sunflower.——The Plumbago power-plant is to be moved up to the mine and more machinery will be installed. The lower adit is to be driven 1100 ft. farther. The machinery at the present power-house has been offered for sale.

Rich gravel is being extracted from the Posey Canyon mine. A cross-cut has been driven 60 ft. in the gravel, but the vein-rock has not yet been encountered. At present enough water is obtained from the adit, but soon water will be brought from the Excelsior ditch. The mine is owned by local capitalists.

The Serins mine, owned by Ole Helgeson, situated on Canyon creek between the Mountain View and Arctic groups, has been bonded to E. A. Work and H. Eckhardt. The mine is developed by an adit 300 ft. long, and a raise, giving a depth of 200 ft. on the vein. It is stated that a compressor and a 10-stamp mill will soon be erected.——The Neversweat mine in Willow valley will resume work about June 1. A contract has been let to cut mining timbers.

SAN BERNARDINO COUNTY.

The new hoist for the Quartette shaft was installed last week and the shaft is being sunk with three shifts at work.——The mill for the Big Chief Co. is now on the ground and the erection of it is started. The Quartette will also

Map of Northern California.

build a mill as soon as water is developed on the property.——The Big Chief lease is sinking with four feet of $50 ore in the shaft, and a vein has been found in the adit which is being driven from the west side of the mountain. The vein is two feet wide and is of good milling grade. The upper adit is in 130 ft. and the vein is now being cut, the ore being about $20.——The Sloan lease is working in 30 ft. of ore, a portion of which averages $50 per ton. Nearly 300 sacks of high-grade ore is now piled on the dump, and the lessee is preparing to make a shipment. After cross-cutting three feet from the 50-ft. shaft, which was sunk 30 ft. from the mouth of the adit, the lessees on Piute Belle No. 1 broke into four feet of good milling ore, averaging $25 per ton. Andrews & Marsh are the lessees of this block.——J. D. Goodwin has made a rich find on the Sunrise. At a depth of 50 ft. a cross-cut was run last week, and five feet of $30 ore is showing in the face. The Sunrise is a mile and a half from camp.——The Hart Con. Mining Co. will begin operations next week. The company owns the northern extension of the Oro Belle group, where Hart & Hitt made their original strike. The adit on Oro Belle No. 1 has reached a distance of 125 ft.——Two carloads of ore are now on the dump at the Stampher lease. At a depth of 50 ft. the lessee is driving in the vein. The ore averages $21 per ton, and as work progresses the ore-shoot has every indication of being large.——The Twin Peaks Co. are beginning operations next month on an extensive scale. A hoist and compressor will be installed and a double-compartment shaft will be sunk 200 ft. The Four Tramps lease on Twin Peaks have opened up an immense body of medium-grade ore, averaging $25 per ton. A hoist will also be installed at this lease.

PLUMAS COUNTY.

Active operations will soon be started by the Newton Mining & Development Co., which owns property on Coquette creek, and in Gravel range in western Plumas and Butte counties. The ground will be worked with a steam scraper. S. J. Norris is superintendent.

TRINITY COUNTY.

A five-stamp mill will be erected at the Leibbrandt mine on Rattlesnake creek beyond New River and Canyon creek, at an elevation of 6000 ft. The mill will be hauled from Redding to Coleridge, a distance of 80 miles, and then packed 25 miles over a rough trail. The mine is situated in one of the most remote parts of Trinity county.

COLORADO.

CLEAR CREEK COUNTY.

(Special Correspondence).—On an average 100 tons of mill ore is being treated daily at the Capital concentrator. Shipments of smelting ore are also being maintained, about 50 tons being sold each month. It is reported that within the near future another unit of 100 tons will be added to the milling plant, as the original plans called for a total capacity of 1000 tons at the concentrating works. Over 100 men are now employed in the mine and mill, but W. M. Cooper, the manager, expects to increase the force soon. ——It is believed that connection with the Seven-Thirty shaft workings in the raise being carried from the west Phillips drift run from the Burleigh adit, will be made some time during the coming week. There remains to be broken about 30 ft. of ground, and great care is being exercised to avoid danger to life and property. Drill-holes are kept 10 ft. ahead, as the old levels are filled with water. The Pelican mill, with a capacity of 250 tons per day, is in readiness to be started, and the Burleigh M. & L. Co., which has been performing this work under privileges of leasing any ground in the Seven-Thirty workings that is desired, is making ready for a more active campaign of development. The aerial tramway running from the Seven-Thirty dumps is practically completed, while the one running from the Pelican dumps is in operation. The two tramways have a capacity of 300 tons per day.——The Mendota mill is running night and day. For the present custom ore is being treated. B. J. O'Connell, leasing on the upper Frostberg, is shipping 100 tons per week, the product being lead and zinc. This lessee is stoping upon an orebody that is from 2 to 5 ft. wide.——A. Thoman, leasing on the Gold Dirt, is marketing from two to three carloads of smelting ore weekly that brings a settlement of 6 oz. gold per ton. The milling ore is being treated at the Empire mill and assays $50 per ton after concentrating from four to five tons into one.——Courtney Howard & Co. of Lawson have taken a lease on the Dictator mine, situated on Columbian Mtn. Driving is progressing and a streak of high-grade ore is being followed that measures from 2 to 4 in. across. The last mill run from this mine brought a settlement of 2000 oz. silver per ton, the ore having been mined in close proximity to where the present lessees are at work.——The Sceptre adit is to be advanced 400 ft. to intersect the Sunburst Extension vein. At that time a raise will be carried 370 ft. to connect with the Sunburst adit. The compressor and other machinery is expected to arrive in a few days, at which time machine-drills will be brought into use. Other work is being planned by the manager, C. H. Poirier, and the working force is being increased almost daily.——Early in May the cross-cut, started to intercept the 500-ft. level of the Shively shaft workings, will reach the objective. At that time the old workings will be drained, facilitating the exploration of a vast area of virgin territory. B. J. Martelon, the superintendent, states that if the reserves of low-grade ore are sufficient, a modern concentrating plant will be erected.——The Vesper group of claims in East Argentine, is being developed energetically. Cross-cutting is under way for the cutting of the Vesper, which should be reached, according to surveys, within the next 40 ft. The Vesper produced some high-grade ore from surface workings. W. M. Graves is in charge of the work.——The Lost Treasure mine on Columbian Mtn. is making an excellent showing. Driving is in progress upon a 4-in. streak of 900-oz. silver ore. Occasional shipments are being maintained. W. Cramer is owner and operator of this mine.——Operations at the Joplin M. & T. Co. holdings are being continued vigorously. A streak of ore is being followed on the Gambetta vein that measures from 12 to 18 in. wide, and average assay 64% lead and 50 oz. silver per ton are contained, as has been ascertained from recent shipments.——It is reported that the Centennial mine on Leavenworth Mtn. has been transferred to S. Peacock, representing a syndicate of Chicago capitalists. The water is now being lifted from the fourth, fifth, and sixth levels.——Seven pounds of ore taken from the Tol Reynolds on Alpine Mtn. was reduced to bullion at the local sampler a few days ago and a retort of 2½ oz. pure gold was secured. Homer Davenport is the owner of this mine.

Georgetown, April 13.

GILPIN COUNTY.

The Greater Canada Mines Co. has been incorporated to operate in the Russell district.——The station for the hoisting plant in the workings of the King Bee Co. in the Newhouse adit is completed and ready for the installation of the hoist, which is to be used in the sinking of a winze below the adit level.——A lease and bond has been taken on the Missouri mine in Russell gulch by T. W. Boyd of Idaho Springs. The shaft is being unwatered. There is now 150 ft. of water in the shaft, which is 400 ft. deep.——A force of 25 men is employed at the Fontenac mine at the head of South Willis gulch in the Russell district, and considerable milling ore will be shipped to the Black Hawk custom mills.

SUMMIT COUNTY.

E. G. Tuttle, the manager of the Colorado Gold Dredging Co., operating on the Swan river about five miles from Breckenridge, has recently completed two dredges and they will be in operation at full capacity by May. Each dredge will have a daily capacity of 3000 yards.

IDAHO.

BLAINE COUNTY.

(Special Correspondence).—The Eureka Development Co., Ltd., held its annual meeting in Salt Lake City, Utah, in February, when the following officers were chosen: president, W. A. Wilson; vice-president, A. C. Ellis, Jr.; secretary, Causten Brown. These, with E. B. Critchlow and Henry Eiseman, constitute the board of directors. The company's mine is at Bullion, seven miles west of Hailey. Operations were suspended last November, after having reached a depth of 340 ft. on the incline, with a level in ore running east from it, exposing the main ore-shoot, which is 110 ft. long. Work was resumed in January, 1908, and sinking on the main incline has been in progress since starting up. Almost an additional 100 ft. has been sunk. The shipping ore averages about 55% lead and 65 oz. silver per ton. Electric power for hoisting and operating the concentrating mill will be installed. The mill may be started about May 1. W. A. Wilson has been directing operations here for some time.

Hailey, April 16.

IDAHO COUNTY.

Some rich ore has recently been found on the Snowstorm claim on Red river owned by J. Coverly and R. W. Pittock. ——The Umatilla mine has been sampled by J. H. Jones. This mine has a large body of low-grade ore. This has been developed by a drift 400 ft. in length and nine cross-cuts. The orebody is 80 ft. wide. The main adit is 772 ft. long, striking the orebody 628 ft. from the portals and at a depth of 240 ft. It is stated that a railroad will be built into the Seven Devils country by the Copper Butte Milling Co., which holds a lease for 10 years on the Peacock copper mine.——Work has been resumed on the Champion Copper Co.'s mine. A contract has been let for 100 ft. of work to J. I. Johnson of Wallace. An upper adit has already been driven about 800 ft. and considerable cross-cutting has been

done, giving a depth of 300 ft. and showing a vein about 25 ft. wide carrying some rich copper ore. The new adit has been driven about 70 ft. and has reached the vein, which carries some high-grade copper ore with about $10 per ton in gold.——The adit on the Buffalo mine is in 300 ft. A contract has been let for 1300 ft. of work, and the vein should be struck at 900 ft. from the portal. The vein has

A Prospect in Nevada.

been developed on the surface by a 30-ft. shaft. The new adit will give a depth of 600 ft.——A creosoting plant is being erected jointly by the Bunker Hill & Sullivan Co. and the Government Forest Service at Wardner. The plant is almost completed. A 6-ft. cylinder is being constructed, having a small steel track on the bottom. The timbers will be loaded on handcars and pushed, car and all, into the cylinder. The creosote will be turned into the cylinder until full, where it will be allowed to remain from 6 to 8 hr. The liquid will then be drawn off and the timbers will be ready for use.

The litigation between the Hercules and Ambergis mines in connection with the adverse suits between the Anna and Ambergis claims and between the Rattler and Little Chief claims, has been settled and the Hercules, in consideration of a stock payment has agreed to give a deed to the Ambergis company for all of the ground conflicting with the Ambergis claims.

NEVADA.

ESMERALDA COUNTY.

The recent discovery of rich ore at the Great Bend mine in the Diamondfield district is proving to be important. The lessees have developed an ore-shoot for a distance of 125 ft. on the 300-ft. level. A winze has been sunk 50 ft. in ore. ——Rich ore is still being extracted from the Rogers-Syndicate and Little Florence leases. The Rogers-Syndicate is extracting ore from two deposits about 25 ft. apart. The shipments from Goldfield mines last week were higher than any made during a similar period since the labor troubles. The total shipments were 1870 tons, valued at $193,855. The average value of 820 tons shipped to the Western Ore Purchasing Co. was $175 per ton. The shipments from Tonopah from April 8 to 14 were as follows: Tonopah Mining Co., 3314 tons; Tonopah Belmont, 1213; Tonopah Extension, 99; Tonopah Midway Co., 293; McNamara, 99; Tonopah Mining Co., 98 tons. Total, 5116 tons.

LINCOLN COUNTY.

A shipment of ore is being made from the Deberry and Megede lease on the Boston mine to the New Era mill.—— The New Era Mining Co. will start development work on the American Girl group, which adjoins the Esther mine. ——Machinery for the small smelter to be erected at Rich Hill by the Santa Barbara-Searchlight Mining Co. is due to arrive shortly. Roads are being built and excavations for the foundations are being made.

NYE COUNTY.

Rich ore has been found on Little creek, 12 miles north of Round Mtn. The discovery was made by prospectors who have obtained a lease from the original locators. It is stated that the vein assays $900 per ton for 12 in. and $10 per ton for two feet.——A rich strike is reported from Manhattan. The Shea lease on Union No. 9 has encountered high-grade ore. A 3-in. streak is said to assay $2 per lb. and an 18-in. vein of $200 ore is being extracted.

UTAH.

JUAB COUNTY.

The hoisting engine at the Raymond-Illinois mine broke last week and the cage and cable fell to the bottom of the shaft. Nobody was hurt, but the mine will be shut down until repairs can be made. J. C. Sullivan is manager.—— The sinking of the main shaft at the Little Chief mine is being continued. The shaft is 1000 ft. deep and will be sunk to 1500 ft. Development will be continued on the 1000-ft. level while sinking progresses.——The Grand Central mine will start again on May 1, and a shipment of ore will be made to the new Tintic smelter.——The new smelter at Silver City is progressing rapidly and ore will probably be received after May 15. W. L. Mangum is manager. The plant will be operated by electricity and a power line is being built into Tintic from American Fork canyon. It is expected that smelting can be begun by June 1. In addition to the work being done upon buildings, furnaces and other equipment of the smelter, a large force of men and teams is now grading for sidetracks.

CANADA.

BRITISH COLUMBIA.

Following is the tonnage of ore shipped from and crushed at the mines of Rossland for the week ending April 11, and for the year to same date:

Mine.	Week.	Year.
Centre Star	3,320	49,918
Le Roi	1,435	25,169
Le Roi No. 2	595	9,013
Evening Star	....	428
Iron Horse	....	38
Blue Bird	....	30
Totals	5,350	84,596

At the smelter of the Consolidated Co. at Trail there was received during the week 6150 tons. Besides that from Rossland, other shipments were as follows: Rambler-Cariboo, 66 tons; North Star, 71; Cerro Verde, 9; St. Eugene, 563; Whitewater, 43; Eva, 23; Snowstorm, 468; Silver Cup, 33; First Thought, 294; True Fissure, 32 tons. At the

The Miller Lease at Rawhide.

Granby smelter at Grand Forks 21,063 tons of ore was received during the week from the Granby mines. At the Le Roi smelter at Northport there was received during the week 1493 tons of ore. The Le Roi mine sent in 1435 tons and the First Thought 56. The district shipments for the week were: Boundary, 21,063 tons; Rossland, 5350; Slocan-Kootenay, 1733. Total for the week, 28,145 tons.

Special Correspondence.

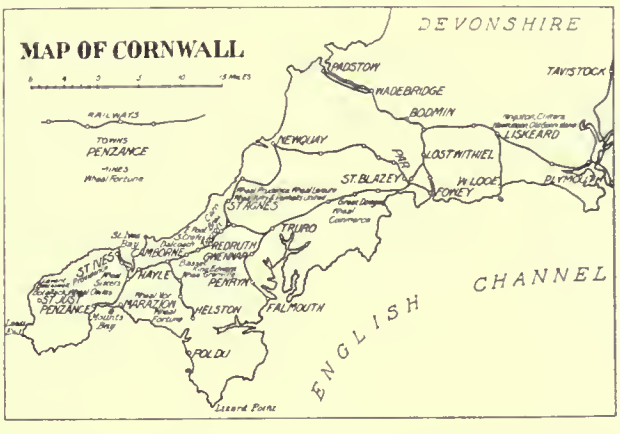
LONDON.

The Institution Meeting.—Salt Union and United Alkali Affairs.—New Plant for South Crofty.—Clitters Changes Management.

The annual general meeting of the Institution of Mining & Metallurgy was held last week and the revised rules of membership outlined in a recent issue of the MINING AND SCIENTIFIC PRESS were unanimously adopted, as were also the new rates charged for membership. I wish to point out that this increase in the yearly subscription for members from two to three guineas and for associates from one and a half to two guineas is not intended to affect present members or associates, or those who may be elected before the end of the present year. The new rates will be for new members solely. It will be to the advantage of those contemplating application for membership to hurry up and be elected before the end of the year, and so save themselves a guinea or a half-guinea a year ever after. At the general meeting the address of the new president, Mr. Alfred James, was read in his absence by Mr. Bedford McNeill. The address consisted of a sketch of the advance of things in general during the last twenty years. The most important point urged was the very great advance in the status of the English mining engineer in metallurgical work. When I was first connected with mining operations conducted from London fifteen or twenty years ago, there was a hazy idea that there were no English mining engineers or metallurgists at all. This notion originated in the London offices of American promoters and engineers, who were at that time in great vogue here. They granted that there were plenty of Englishmen who could do assaying and surveying work, but America had to be drawn on for men worthy of responsible positions. For ten years this idea reigned supreme, but it is now being gradually dissipated. Several reasons for this winning back of their birthright on the part of the Englishman may be given. One reason is that its originators are not now in our midst, and another is the increasing influence of the Institution of Mining & Metallurgy. I am fully convinced that the system of post-graduate scholarships inaugurated at the Royal School of Mines by the Institution will still further advance the status of the English mining engineer.

The Salt Union and the United Alkali Company are two national institutions that have been under a cloud for the last twelve years, owing chiefly to foreign competition. The Salt Union owns large tracts of the Cheshire salt fields. In 1888 when it was formed as a consolidation of a great number of minor interests, the output of salt was about two million tons a year and the gross profit £500,000. The nominal capital was £1,000,000 in preference and £2,000,000 in ordinary shares, while the debentures amounted to £1,200,000. At first a dividend at the rate of 10% was paid on the ordinary shares, but this soon fell away until it was only 1% in 1896, since when nothing has been paid until this year. The preference dividend has been paid intermittently from 1897 to 1906, the total for all these years being 18%. The yearly output of salt has for a long time been under the million mark, and has been as low as 800,000 tons. In 1902 a drastic remodelling of the business took place. The ordinary shares were reduced to £800,000 and the preference to £600,000, and many economies in administration effected. Some improvement in results took place, but it was not until 1907 that divisible profits were made. Even now the dividend on the ordinary share for 1907 is only 1¼% on the reduced value of the share, or ½% on the original value. The preference shares get 8½% on the reduced value of the share. The output of salt in 1907 was 910,000 tons and the net profit £127,075, the latter figure comparing with £70,104 in 1906 and £68,400 in 1905. The debentures take £54,000, and £52,000 goes to the preference shares, and £10,000 to the ordinary. It is to be hoped that this recovery will be maintained and the profits increased in future years. The other company referred to, the United Alkali, is a consolidation of a great many chemical manufacturers, copper and other metal producers, in Lancashire, Newcastle, and Glasgow. Formed when the chemical trade was booming, its capital on the reduced profits now ruling looks inflated, and the ordinary shares are not of great value. The nominal capital does not represent the actual present position of the company, and the poverty of the distribution on the ordinary shares is an anomaly that cannot be helped. The company is one of the best organizations existing, and the state of its ordinary dividend is its misfortune, not its fault. In 1907 a net profit of £479,349 was made. Of this £134,187 was distributed as debenture interest, £187,878 went to the 7% preference shares, and £56,875 to the ordinary shares, being at the rate of 2%. In addition £75,000 was placed to reserve and £15,000 to debenture redemption fund. The profits were slightly lower than in 1906, chiefly on account of the higher price of fuel.

The South Crofty is one of the Cornish mines recently taken over by a London group of financiers, Messrs. Allen & Meyerstein, who believe in a clean sweep of old Cornish machinery and a liberal expenditure of money on modern plant. It is nearly two years since they entered into possession. About £13,000 has been spent on new plant, of which £8000 has gone for a 40-stamp mill of the modern



type in place of the old Cornish stamps, together with Buss tables, Frue vanners, etc. The remainder has been spent for magnetic separators and electric machinery. About £31,000 has been spent in sinking new shafts, in exploration work, additional buildings, and general equipment. In December last the entire new mill was in operation, treating about 120 tons a day. Development has turned out so well that the directors have decided to erect an additional 40 stamps, and have issued 6000 new £1 shares at £4 each, to obtain the necessary funds. The policy of increasing output at the present juncture is open to criticism, as the results for the half-year ending December 31 last have not borne out the prophecies of the directors. But people are ready to put up the money. During the six months in question the amount of ore stamped increased from 50 to 120 tons per day. The total output of tin concentrates, wolfram, and arsenic is not given, but the receipts from the sale were £11,349, £3766, and £2002 respectively. The total expenses were £17,300, and after adjusting the accounts as to a number of small items, a profit of £195 was made. Last summer Mr. Allen was talking about a profit of £200 a day. Surely a good profit should be obtained before issuing new shares at such a high premium to increase the plant. The only excuse for increasing the new plant now is that the information already in the hands of the directors points to the fact that the margin of profit will be small unless the property is worked on a large scale.

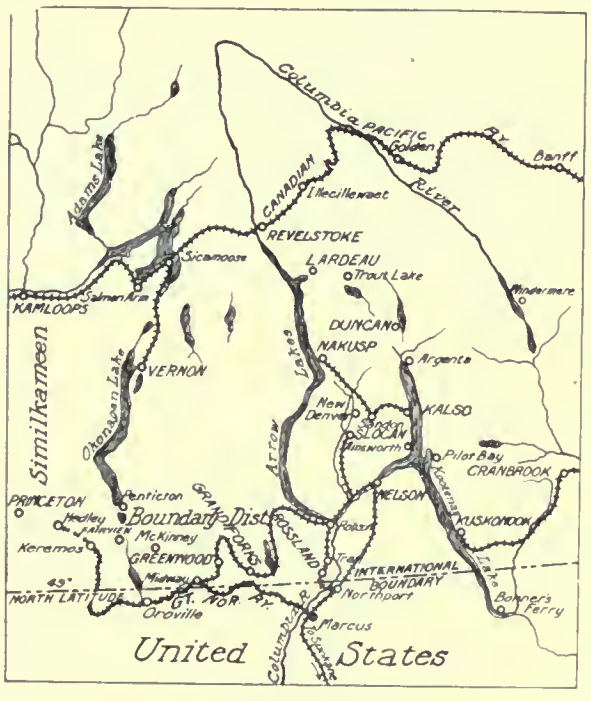
Last week I referred to another Cornish mine, the Clitters United, and mentioned that owing to a number of circumstances a loss had been made on working during 1907, in spite of the fact that an interim dividend had been paid during the year, and that further capital was to be raised. It is now announced that the Messrs. Schiff are resigning from the board and handing over control to the Allen and

Meyerstein group. It will be remembered that the Clitters was the first mine in Cornwall reopened by outsiders, and that in those days Allen and Meyerstein and Schiff worked in harmony. It was the Messrs. Schiff, and their consulting engineer, F. Dietzsch, who were the pioneers in reopening work and in designing the modern plant. The Allen-Meyerstein group are now supplying the new capital, and the management will in future be in the same hands as South Crofty and Botallack. The Messrs. Schiff are now concentrating their attention on the Wheal Jane mine near Chacewater. It would be interesting if more outsiders would take up Cornish mining, but most of the big firms are afraid. A well known American mining man said to me the other day that they gave Cornishmen credit for knowing enough about mining to have taken out everything that was worth taking already. The fact is that though the simpler tin ore at shallow levels is mostly gone there is both free concentrating ore at lower levels and complex ores in the upper levels that would pay to work with improved modern processes.

ROSSLAND, BRITISH COLUMBIA.

Railroad Building. — Several Important Branches. — Grand Trunk Pacific. — Mining News. — Ore Shipments. — Operations at the Granby. — Canadian Pacific Spiral Tunnel.

Work on a small scale has been started on the Pot, Alberta, and Sunset claims. It is reported that a new vein has been uncovered on the Sunset. The extensive development work being done on the Giant-California by the Granby Is showing good results. Ore shipments for the week ending April 11, amounted to 5350 tons; the



British Columbia.

Le Roi, Centre Star, and Le Roi No. 2 being the only shippers. The Trail smelter received 6150 tons for the week. This smelter and refinery is now producing 20,000 tons of lead annually, besides copper matte, fine silver, and gold bullion. The matte goes to the Tacoma refinery, the gold to the U. S. Assay Office at Seattle, and the silver to Ottawa, New York, and Hongkong. Richard Merton, of Frankfort, while in the Boundary last week stated that during his travels he had seen nothing that compared with the Granby workings for low costs and general economy. It was his opinion that copper would find its normal figure of 17c. or 18c. after the financial clouds had passed away. Granby shipments last week were lower than for some time previous. The product of the mines was 21,063 tons and the smelter treated 22,820 tons. The cost of mining and smelting has been got down to $2.50. On the 10th instant the Granby paid $55,000 to its employees in Phoenix and $35,000 at the smelter.

News has been received that the Minister of Finance looks favorably upon the application of the lead miners of the Slocan and that it is now assured that the extension will be granted and the limit raised from £16 to £18. A company has been organized to take over the Ophir-Lade, Lucky Jack, and Swede groups of the Great Northern Mining Co. and development work is to be resumed. The Silver Cup has opened up a good orebody. Their output of 160 tons in March netted $10,000. A strike of $80 ore has been made on the St. Elmo claim of the True Fissure group. Shipments through Kaslo for March were 548 tons. A strike has been made on the Half Moon at Moyie. The Sullivan smelter is to be operated until the ore on hand is treated.

Probably the most interesting piece of railway work being executed in British Columbia at the present time is that now going on near Field, on the main line of the Canadian Pacific. At this point the old grade is 4.5%, and it takes three and four locomotives to push the transcontinental trains up the hill. The Kicking Horse canyon being too narrow to permit of loops, the new railroad crosses the river and cuts into the solid mountain, and will be built through a tunnel 16 ft. wide by 24 ft. high, 3200 ft. in length, making a complete spiral and emerging at a point 70 ft. higher than the first entry. By means of tunnels the grade will be reduced to 2.2%. About 500 men are employed on the work and open-cuts; the grading should be completed by July or August. It will take 12 months to bore these tunnels.

The Fernie-Michel extension of the Great Northern is now about ready for operation. It is stated that passenger and freight service will be extended to Michel from Spokane as soon as a government inspector has examined and accepted the work. The extension of the V. V. & E. from Keremeos toward Hedley is now 20 miles from the first named town. There are yet some large cuts and fills to be finished and a couple of bridges in this 20 miles. Contracts have been let for clearing the right of way from Hedley to Princeton, a distance of 24 miles. There is no word of the resumption of construction on the Midway-Vernon.

It has been rumored here that the Canadian Pacific, which was understood to be behind the Kettle Valley lines, was to take over the property in April. However, this is denied by C. P. R. officials, probably because an act of this nature would annul the cash bonus that the charter of the Kettle Valley lines carried.

Ten million dollars will be expended on the contract just let for a portion of the western end of the Grand Trunk Pacific, and nearly 6000 men will be put to work as soon as the work can be got ready for them. The work to be started immediately is the 100-mile section from Prince Rupert to Kitsilas canyon, and 60 miles from Kitimaat to Kitsilas. Foley, Welch & Stewart, the contractors, are now engaged in collecting their outfit from points where they have been working in Manitoba, Alberta, Washington, and British Columbia. It will require 500 cars to transport their $200,000 equipment, which will include 600 horses, compressors, drills, graders, and scrapers.

BUTTE, MONTANA.

Hauser Lake Dam Bursts.—Wash-out Affects Great Falls Smelter.—Mines Resuming.—Helena District.

The Great Falls smelter of the Boston & Montana Co. has practically been shut down on account of the damage to the Great Northern railroad, between Butte and Great Falls, caused by the flood from Hauser dam on the Missouri river, which broke April 15. About 22 miles of railroad track was washed out. The Hauser Lake dam is the property of the Missouri River Power Co., which furnished electric power to nearly all the mines and smelters in Butte, and the accident cut off the power, necessitating a shutdown of all the mines for a day until connections could be made with the reserve steam power plants. The Boston & Montana Co. is shipping ore to the Washoe smelter at Anaconda.

The Washoe smelter has contracted to receive 100 tons of

ore per day from the Snowstorm mine, and shipments are expected to begin next week. The Washoe has about 6000 tons of Snowstorm ore in its bins now. It is used chiefly for converter linings. The Snowstorm will then be shipping nearly 400 tons of ore per day to various smelters.

The Butte & London Development Co. has finally been forced to succumb to the effect of the financial stringency, and has closed its property. The pumps have been taken out of the mine and the workings will be permitted to fill with water. The Butte & London started out as one of the best financed among the new companies, and continued work longer than many of them. It was the original intention to sink the shaft at least 1500 ft. before cross-cutting and doing exploratory work, but sinking progressed slowly, and the financial crash caught the company when the shaft was but 1100 ft. deep. It was then decided to explore the veins at that depth in the hope of finding commercial ore. Half a dozen good veins were cut and driving was done on two of them. They were opened to a considerable extent and bunches of ore assaying well in copper and silver were found, but it became evident that sufficient depth had not been attained. The treasury had become exhausted; several efforts to raise funds by the sale of treasury stock were unsuccessful, and a shut-down was inevitable. The company has been under the management of some of the most energetic operators in the Butte district, and their disappointment is keen in not being able to continue work. Mining men generally are of the opinion that the Butte & London will become a large copper producing mine some day. The company has no debts and owns its ground outright, consisting of more than 100 acres. It has the best surface plant and equipment of any of the new companies, and its large three-compartment shaft is one of the best in the district. The company has a large amount of stock remaining in the treasury, and if financial conditions improve it will probably have no trouble in raising more money.

Preparations are being made to resume work on the Pilot-Butte claim by the Pilot-Butte Copper Co., owned chiefly by Milwaukee capitalists. The latter also felt the financial squeeze, and a suspension of work was ordered about a month ago. The Pilot claim is located in the North Butte district, among big mines.

The Ida-Montana Co. is preparing to resume work on its properties in the eastern part of the Butte district, adjoining the mines of the Amazon-Butte Co., and will spend $40,000 on additional machinery for its plant and in putting in an electrical equipment, including a large electric pump that will be placed on the 1000-ft. level. The pump will have a capacity of 1500 gal. per min. The new machinery has been ordered and sinking will be resumed as soon as it is installed. The shaft at present is but 550 ft. deep, but will be sunk to the 1200-ft. level without stopping. On the 250-ft. level a vein 60 ft. wide has been opened, showing 7 ft. of good ore.

Sinking on the Raven shaft by the Raven Mining Co. was suspended some time ago and development work has since been confined to cross-cutting, but with no great success so far as the discovery of ore is concerned. A cross-cut has been driven to the vein on the 1100-ft. level, and work is going on there now.

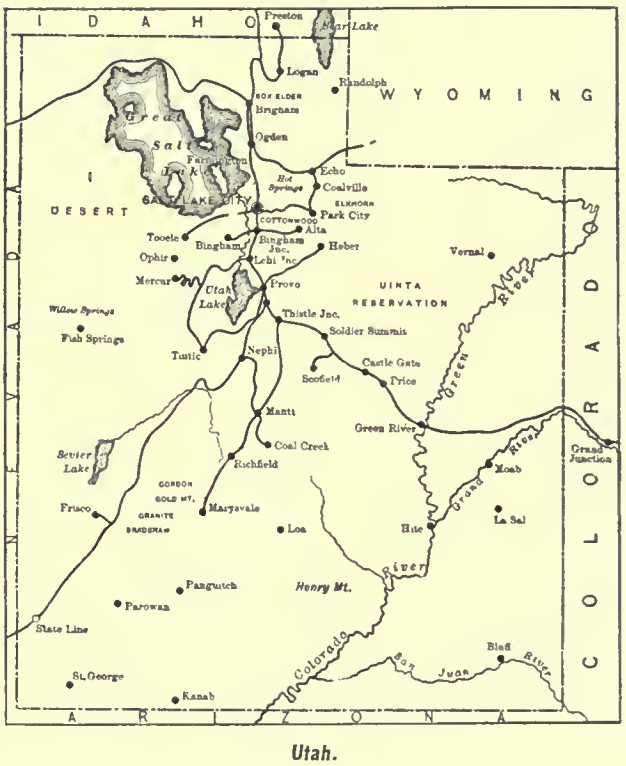
The Souvenir Gold Mining Co. of Butte, which is operating gold properties in the Helena district, is opening some rich free-gold milling ore in the Court House claim, which was the original Whitlatch Union mine, on the vein of which, in adjoining ground, a great amount of ore was taken out years ago. The vein is 10 ft. wide. Twenty inches of the ore on the hanging wall assays $72 per ton, and the remainder of the vein goes $20. The company owns 1500 ft. on the vein. A new lead has also been opened on the Wisconsin claim, owned by the Souvenir company, about 900 ft. south of the rich Spring Hill mine. The vein is 2 ft. wide and is free milling. In the Noyan vein a new orebody has been opened, the lowest assay of which gives $29 per ton. The company has a 10-stamp mill on the property and is installing new boilers and making connections with an electric-power line, with the object of operating the mill by electricity. The mill will be enlarged by the addition of 10 stamps, which will be in operation by the middle of May. It is stated that there is now enough ore on the dumps and blocked out in the mines to keep the mill running more than a year.

SALT LAKE, UTAH.

New Tintic Smelter.—Railroad Through Silver City.—May Day Resuming Work.—Apex Mine.—Novel Use for Churn Drill.

The Bullion-Beck and Champion Mining Co. are operating partly on company account and partly by leases, and are shipping 1000 tons of ore per month. The deepest workings are 1500 ft. below the surface, the shaft being 1300 ft. deep, with a 200-ft. winze below that depth. Mining is in progress on various levels from the 200 to the 1100 ft. inclusive. There is considerable water on the 1300, and a pump is to be installed on that level. The 1500 level, however, is not troubled with water, but permanent water-level was reached a short depth below it, that being on a level with the surface of Utah lake. The ore throughout carries silver chloride and lead carbonate, and a little copper in places. P. T. Farnsworth is general manager, with L. C. Doty superintendent.

The properties in the Tintic district controlled by Jesse



Utah.

Knight and asociates comprise the Beck Tunnel, Colorado, Crown Point, Iron Blossom, Black Jack, Star Con., and Swansea. The Colorado, Beck Tunnel, Black Jack, and Swansea are well developed and will supply all the classes of ore required at the new smelting plant which is being erected between Mammoth and Silver City. John Roundy is general superintendent of all the mines of this group, and under his direction they are being put in readiness for production so as to supply the new smelter with its required tonnage. A narrow-gauge railroad has been built from the smelter to the mines named, 7 miles in length, passing by way of Silver City. At the new smelter the sampling plant is finished, the two lead furnaces, 48 by 160 in., are installed, one blower is ready, and the flues, dust-chambers, and stack are finished. The stack is of steel, 10 ft. diam. by 150 ft. high. Hand roasters, of the reverberatory type, are being built and a sintering plant, designed by F. G. Kelly of Salt Lake, is being put in. Electric power will be employed throughout. Jacket-water, and water for fire protection, will be pumped from the 1000-ft. shaft of the Swansea mine at Silver City. For this purpose

a triplex electric-driven pump will be installed at the 1000-ft. station of the Swansea. The two lead furnaces are intended to be blown in about June 1. In addition to the above equipment, a copper furnace has been ordered. The plant was designed by H. P. Saunders, and will be operated under the superintendence of R. S. McCaffrey.

The May Day Mining Co. is operating the May Day and the original Uncle Sam mines under one management, utilizing the Uncle Sam shaft, through which all hoisting will be done. Prior to the shut-down last autumn they worked a force of 200 men, and a part of this force may be put on again by April 20. The Uncle Sam will soon be used for concentrating the second-class ore on the dump at the May Day mine. The Apex Mines Co., in which E. B. Jones, Frank P. Swindler, and others are interested, is prospecting and exploring its group near the Grand Central and Centennial-Eureka. A first-class hoisting plant and air-compressor were installed a few months ago. Since that time a shaft has been sunk 1325 ft. deep, and development is in progress from the 1300-ft. station. A winze is also being sunk. The shaft is three compartment, two being for hoisting purposes, and one for a manway. The cage compartments are each 4 by 4½ ft., and the manway 40 by 54 inches.

The United States Supreme Court has affirmed the judgment of the Court of Appeals in the Kempton lode mining

The New Tintic Smelter.

case, which has been in litigation for a number of years, which gives the United States Smelting, Refining & Mining Co. title to the Kempton claim, which is valued at $1,000,000. E. A. Wall is the loser by the decision. The Tintic Smelting Co. will begin to receive custom ores on May 15, and in preparation for this the mines of the Tintic district, which have been closed since about the first of the year, are preparing to resume operation. The lead furnaces will be placed in commission in June, and the copper department in the latter part of July or early in August. A transaction has been closed here for the purchase of the Carbonate mine, one of the oldest producers in Beaver county, by a New York syndicate. The Beaver Carbonate Mining Co., with headquarters in Boston, has been organized to operate it. The property yielded its former owners about $1,000,000.

At a special meeting of shareholders held in Salt Lake, the Nevada Douglas Copper Co. authorized a bond issue of $600,000, bearing interest at 6% and maturing in five years, but redeemable in stock at any time within three years at $7.50 per share. The proceeds are to be applied toward cleaning up the present indebtedness of the company, and further equipping its mines at Yerington, Nevada.

The foundations for the cyanide department of the mill of the Jennie Gold Mining Co. at Gold Springs, Iron county, have been completed. The plant will be in commission in about six weeks. Twenty feet of good milling ore has been developed in two parallel veins on the 115-ft. level. Assay value runs from $6 to $10 per ton.——Development work will shortly be resumed at the Silver King Con. mine at Park City. The Silver King Coalition Mines Co. has assembled a churn-drilling outfit at Park City, and will try the experiment of applying them to provide better ventilation. The first hole to be drilled will be one between the Alliance and the Hanauer adits. Ore shipments from Park City last week amounted to 649 tons, Daly Judge furnishing 279 and Daly West 37.

Practically all the equipment for the converter plant ordered for the Yampa smelter in Bingham canyon has been assembled and is being placed in position. It will be ready for use about June 1.

COBALT, ONTARIO.

Mining by Government.—Right of Way Mine.—Nipissing Property.—Ore Shipments.

The Cobalt mines began shipping silver ore in 1904, since which time approximately 25,000 tons have been mined and shipped to various smelters. This ore has averaged $760 a ton. Taking into consideration the narrowness of the veins we must conclude that the ore is very rich. While no smelters have been provided at Cobalt, there have been erected two concentrator plants for custom ores, besides which at least six mills have been put up on individual properties. We may now expect that the walls of the veins which often carry leaf silver, as well as the cullings from the ore already shipped, will provide quite a tonnage of profitable ore. The most noticeable feature of the district is the great number of small veins discovered and worked. It appears as if every inch of the ground must be prospected. Ore is being shipped to such widely separated places as Denver, Perth Amboy, N. J., Trail, B. C., Carnegie, Pa., Swansea, Wales, Hamburg, and to Thoroid, Ontario, the latter being a new plant. A smelter lately erected at Trout Mills will also handle Cobalt ores.

For some time past the Government has been operating a mine in the Gillies Limit for whose benefit it is difficult to determine. It appears rather singular that this mine should have been operated for so long a time without the conditions of the workings having been made public. We understand the shaft is down over 700 ft. As few of the Cobalt mines are down a third this distance it would be very interesting to have a geological section of this shaft. A recent paper reports that the first shipment of ore from this mine will soon be made and then continues, "in a short time now it may be expected that the Government mine will be placed on a paying basis. The ore is not of the richest quality found in the Cobalt area, but it is of good paying value, and the officials in charge of the mine are confident of the success of the undertaking. The work on the Gillies Limit has been carried out on the most modern lines, and much of that which has been of an experimental nature has resulted in the placing of important information in the hands of the department."

It would be interesting if those having the information would provide the figures for comparing the wet with the dry concentrating plants. The Muggley Concentrator plant has installed stamps with Wilfley and Frue machines for concentrating. The Lawson mine is still tied up with litigation. The case will go before the Court of Appeals at the next sitting. The Right of Way mine is certainly the most remarkable in the district. It will be remembered that the Government sold this strip of ground along the right of way of the railroad 99 ft. wide, and two miles long, for $50,000. The company had only been in possession a few weeks before they shipped a carload of ore which paid for the mine and expenses of mining. To date four veins of good ore have been opened, and all parallel to the line of the railroad, so that the narrow width has not lessened the value of the finds. The Silver Queen vein crosses this property into the Princess ground as well as some veins from the Townsite. The question has often been asked why the Nipissing, which has such a large acreage, does not lease portions of the property not now being developed. Such a course would be a benefit to the district as well as to the company. In fact there is less leasing of ground in Cobalt than in any other mining camp. It may be that the owners have such confidence in the value of the ground that they want it all for themselves.

MEXICO.

El Tajo Reduction Plant. — Ayutla Smelter, Jalisco. — Milling Output, Guanajuato.—Orteaga Mine.

A reduction plant with a daily capacity of 30 tons will be erected at the El Tajo property of the El Tajo Mining Co. of New York in the San Sebastian district. Orders for the machinery will be placed at once, and it is hoped to have it on the ground before the heavy rains commence. The plant will consist of stamps, concentrating tables, and a cyanide annex. There is plenty of wood available for fuel. It is estimated that the milling ore now available in the old workings of the Tajo mine is sufficient to keep the 30-ton plant busy for several years. By the time the adits now being driven are completed and new orebodies opened up the company will have its reduction process perfected, and will be ready to increase the capacity of its plant to 100 or 200 tons daily. The air-drill plant ordered for the Tajo mine some time ago recently reached the property and is now being installed. In a little while the drills will be in operation and the tunnel work will be moving along much more rapidly. Several substantial buildings have been erected at the mine. If the reduction machinery reaches the property before the rains block traffic, it is believed that it will be possible to have the plant in operation by next August or September.

The Ayutla smelter of the Carrizo Copper Co. is rapidly nearing completion, and plans are now being made to blow in not later than June 1. The furnace, blowers, boilers, engine, and other machinery are in place, and there now remains to be completed only the smokestack and dust-chambers. The fuel on hand consists of over 300 tons of coke and a big supply of firewood. Little, if any, charcoal will be used. The company has finished the erection of office buildings and bodegas, and the houses for the workmen are nearing completion. The concentrating plant at the properties of the Ayutla Mining Co. is in operation, and as soon as additional crushing machinery is received and installed the plant will be kept running night and day. The mines and mill of the Ayutla company are under bond to the Carrizo Copper Co. and ores as well as concentrates will be supplied to the Ayutla smelter. It is believed that these mines are capable of furnishing supplies for a much larger smelter than the present 75-ton plant of the Carrizo company. Ores from other mines in the Ayutla district are being purchased, and by the time the company is ready to blow in the smelter there will be a big supply on hand. The erection of the Ayutla smelter is attracting much attention, and as soon as smelting operations are commenced there is certain to be great mining activity in that section of Jalisco. At the present time there are few empty houses in the town of Ayutla, and rents there are advancing.

The present activity in Guanajuato is exemplified by the following output for March of the several properties doing a milling business there:

	Tons.
The Peregrina Mining & Milling Co.	12,400
Guanajuato Reduction & Mines Co.	12,600
Amalgamated Mining Co.	9,000
San Prospero Mill	6,000
Nayal Mill	1,500
Consolidated Mining Co.	11,200
Pinguico Mines Co.	6,750

In addition, the camp produced during the month 12,000 tons of high-grade shipping ore. The ores milled in this camp at present yield about ₱20 per ton. They consist in the main of the lowest-grade ores, and are mostly made up from dump and mine-fillings. All of the properties are, however, gradually increasing the grade of ore as mine development proceeds, and while the profits at present are very handsome from milling only the low grade of ore, the immediate future will show even more gratifying results.

The Orteaga Mining Co. of Cananea resumed operations on February 15, and is blocking out ore so that when the Greene-Cananea smelter starts up in June it will become a steady shipper. The ore struck three weeks ago in the 822-ft. tunnel is different in character from that prevailing in the district, containing much bournonite. The finer crystals assay copper, 41%, silver, 12 oz., and gold, 0.06 ounce.

DENVER, COLORADO.

Leasing in Clear Creek District.—New Oil Company.—Explosion in Coal Mine.—Cripple Creek Items.—Craig Placer Ground.—Bagley Tunnel.

The leasing system is steadily gaining in the Clear Creek district. At a recent meeting of the directors of the Old Town Mining Co. at Idaho Springs it was decided to operate the whole of this extensively developed mine under the leasing system. The old Pyrenees mine, near Central City, has been taken under bond and lease by F. M. Slater, who has had the property surveyed, and is now putting the mine in working order. The repairs on the Golden smelter are nearly complete. The plant will treat the ores from the Saratoga mine. The various tunnels, starting in the vicinity of Idaho Springs, were advanced with a fair degree of rapidity during March. Work on these enterprises is being pushed harder this month. The crew on the McClelland tunnel seems to be trying to equal or exceed the record being made in the Cripple Creek drainage tunnel. Articles of incorporation of the Colorado Springs Oil & Gas Co. have been filed in the El Paso county clerk's office. The company is capitalized at $1,000,000, divided into the same number of shares. The company intends to start drilling operations at once, about three miles southeast of Colorado Springs.

An explosion occurred at the Champion coal mine of the Royal Coal & Coke Co., of Durango, on April 14. The workings were badly wrecked, and three persons were fatally injured. A letter had been received by the superintendent on the previous Thursday, stating that the mine would be blown up unless made safe at once by repairs. The mine was at once inspected and declared safe. Investigation is being made by the county authorities.

The lessees mining on the El Paso Consolidated Co.'s territory at Cripple Creek, are now producing considerable ore. Their success has stimulated others. A new company has been formed, known as the General Leasing Co., which has taken a lease on the Hardwood claim on Ironclad hill. Abram Rapp, former general manager of the Gold Sovereign, is in charge of operations. Conundrum mine has been leased for two years to a company of Cripple Creek miners. One of the most important dump leases secured of late has been the one on the tailing dump of the old Rosebud mill, in Anaconda gulch. Craig, Norris, and Wright, the lessees, are shipping the tailing from this old chlorination mill to Colorado City. The Portland Gold Mining Co. has just distributed its usual quarterly dividend of 4c. per share, making a total of $7,867,080 paid by the company to date. A new company, known as the Craig Placer Mining Co., has purchased 680 acres of placer ground in the Craig district, and has secured water rights on Fortification creek by the purchase of the Meisner ranch.

The Frisco Mines Co. at Animas Forks reports fine progress on the Bagley tunnel, which is being bored into Houghton Mtn. at the rate of about 200 ft. per month. Only one shift has been working during the winter. The breast of the tunnel is now in about 4900 ft. and many veins have been cut during the progress of the work, among them the big Sewell vein, which is more than 100 ft. wide and which outcrops on the surface for a distance of two miles, all in the territory of the Frisco property. The continuation of the work will send the big tunnel through the ground of the Old Red Cloud and other famous properties of the early days, and when the north portal is reached, somewhere in the vicinity of Mineral Point, the Frisco people will have completed one of the really big feats in mining in the San Juan. The entire length of the tunnel will be about two miles. Little or no work has been done in exploring the veins which have been crossed, this being reserved for the future. With the arrival of summer and the regular running of trains to Animas Forks, it is probable that the task of driving the tunnel will be facilitated by adding one or two more shifts.

Concentrates.

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

Rhyolite is an eruptive rock having the same chemical composition as granite. It may be considered the volcanic equivalent of granite, which in fact it would have become if it had cooled slowly enough to permit the fused mass to separate completely into distinct mineral grains.

Silica refers to a substance considered as a chemical compound, namely, the oxide of silicon, or silicic acid. The same substance considered as a crystallized body is known as quartz, whether occurring in definite crystal form or massive. In uncrystallized masses, of horn-like appearance, it is called chert or flint.

Tellurium may be detected by pulverizing the suspected substance, moistening sufficiently to cause it to adhere and not be blown away, and then strongly heated on a piece of porcelain in the oxidizing flame of the blow-pipe. A coating will be formed on the porcelain, which upon being moistened with sulphuric acid becomes rich crimson in color.

Meerschaum has been found in two deposits in the upper Gila valley in central Arizona, one being about 23 miles east of north, and the other at a mine about 12 miles northwest of Silver City. The deposit lies in the bottom and walls of Bear creek, occurring in veins and lenses. The quality is not equal to imported meerschaum, but it may improve when the unaltered mineral is developed.

A good method of thawing dynamite is as follows: Prepare a strong wooden box of the size required and line it with cloth. Have a tight fitting lid and place in the centre of the box a can, which is also covered tightly. Then place hot water in the can and cover that. Place the powder in the box and heat from the can of hot water will thaw the dynamite gradually and thoroughly, and then it can be kept for hours in a convenient place ready for use. The tight cover will retain the heat in the box for a long time, and all danger will be removed.

The color of slag in crucible assays often indicates the nature of the metal present. Light to dark green or black slags are colored by various proportions of ferrous silicate. When iron is absent, the color of lead silicates may predominate, or white and gray or colorless slags, due to silicates of lime, magnesia, or zinc, be produced. Copper produces red slag, due to cuprous silicate. Cobalt gives blue slag. Lead and soda form easily fusible silicates, and the latter should be used in excess with zinky ores, to prevent a pasty slag, which holds beads of lead.

Bauxite is mined in Arkansas, Georgia, and Alabama from irregular masses near the surface, generally enclosed in walls of boulders and clay. It is derived from the decomposition of highly aluminous igneous rocks. The best grade of ore ranges from 56 to 58% Al_2O_3 and about 8% SiO_2. The second grade averages 50% Al_2O_3. The ore should be free from iron. The ore is worth about $4.50 and the domestic output is about 78,000 tons, and the imports, chiefly from France, amount to 18,000 tons.

Platinum occurs in placers, and is not found in workable quantity in veins, although associated with copper and nickel in deposits of sulphide masses in Ontario, Canada, in Norway, and some other regions. It is also commonly associated with chromite, and is found in rocks rich in minerals carrying iron and magnesia. The grains found in placers are therefore supposed to have been derived chiefly from such rocks as peridotite and dunite. It does not occur in acid, that is, silicious rocks, like those of the granite-rhyolite group. An exception to this exists, however, in the case of a platiniferous quartz vein in New Zealand. This lies close to altered magnesian rocks, from which the platinum was undoubtedly carried in solution, to be subsequently deposited with the quartz. The natural solvents of platinum in the rocks are not certainly known.

Barytes is used for the manufacture of paints, porcelain, and as an adulterant and filler in paper and other industries. The principal producers are in Tennessee, Virginia, and North Carolina. The average price is $4 per short ton for crude ore. The raw material is first ground and then bleached with sulphuric acid, after which the product is worth about $18 per ton. The two most objectionable impurities are iron and calcite. Limonite is often associated with barytes, and this must be removed for paint manufacture, while calcite absorbs much acid, and hence is detrimental. The separation of barytes from the impurities has been effected by acids, but jigging is cheaper and the difference of specific gravity of baryte and calcite or gypsum, which are commonly associated, make this form of separation cheap and efficient. This method of separation will probably find wider application in the near future.

Phosphate rock occurs over wide areas in Utah, Wyoming, and Idaho, associated mostly with light-colored limestones near the base of the upper division of the Carboniferous strata. The underlying sandstones and quartzites from 200 to 400 ft. below the phosphate deposits, serve to aid its discovery, which is usually difficult owing to concealment of the beds almost everywhere by soil or slide-material. The deposits are almost entirely oölitic in structure, the grains being well rounded and black in color. The material possesses a bituminous odor. The lower part of the bed is hard and blocky, the middle portions contain large lime nodules, and the upper part is shaly. The demand for phosphate rock will increase as a means for profitably using the excess of sulphuric acid which will in future be yielded by the smelters as a result of suppression of the smoke nuisance. At present phosphate rock to stand shipment to the Pacific Coast must carry about 32% of phosphoric acid.

THE NEW SAN FRANCISCO.

Written for the MINING AND SCIENTIFIC PRESS
By T. A. RICKARD.

It is two years since the earthquake and fire. A year ago we marked the anniversary by publishing a number of articles descriptive of the re-building of the City. This year we shall comment briefly, for most of us are more intent on looking forward than glancing backward. The sentiment of the disaster has been worn threadbare.

While, in April 1906, San Francisco lost about 325,000 out of the 500,000 of the City's population, the return has been so nearly complete that the population is estimated today at 485,000. In the meanwhile the cities around the Bay—that is, Oakland, Alameda, Berkeley, Sausalito, etc.—have gained 135,000 inhabitants, so that the community by the Golden Gate has actually increased by 120,000. Immigration of home-seekers was evident before the earthquake-fire, hence it is manifest that the disaster did not deter those who wanted to live hereabouts. The fire destroyed buildings and contents valued at $350,000,000. About $180,000,000 has been paid in insurance. In the past two years building permits have been granted representing structures valued at $117,514,495, distributed among 14,370 buildings. Of these, 69 were of the best or Class A type, and they are valued at $16,452,000. In constructing these 14,370 buildings, there has been spent $47,007,797 in labor. There are now 200 hotels in the burned district alone. The financial storm, of October last, found San Francisco in a sensitive condition by reason of local need for money in reconstruction, but the banks stood the strain and the commerce of the City suffered only a temporary depression.

During the first year after the disaster anyone standing on the high ground west of Van Ness avenue looked back upon a ghastly desolation: today he sees the ruins almost obliterated by apartment houses and flats. Standing on California hill, near the Fairmont hotel, the observer then looked down upon acres of burnt brick and twisted iron, above which rose a few leviathan office buildings of steel construction, the grim survivors of a general holocaust. Though gutted by the fire, they were structurally intact, so it was not long before the hurried work of repair made them again the hives of industry. The Crocker, the Call, the Kohl, the Merchants Exchange, and the Flood buildings were among the first to be rehabilitated. It was nearly two years before the Chronicle and Mills buildings became retenanted. The Emporium building is not yet reconstructed. And while this work was being pushed forward with splendid energy, other buildings, some of them large and beautiful, arose out of the débris left by the fire. Among these the Alaska Commercial, the Pacific, the Humboldt Savings Bank, and the California Bank buildings are notable. Nearly all the important structures that were either partly or wholly destroyed two years ago, have been restored on their former sites. The position of the Examiner building is marked by a mess of iron and stone, an appropriate emblem for the incivism of its owner. The rubbish that marks the former site of this newspaper office is called a Class Hearst building and it is said that it can be "Leased as a hole or in part."

Yet to the visitor from other cities, the most striking change in our City is the mending and improvement of Market street, the highway leading from the water-gate of the Ferry building to the radiating roadways. This important engineering work was slow in visible result because the sewers, broken by the earthquake, had to be re-laid, and after that the level of the street was raised, having slowly settled, even before the earthquake, upon the filled ground that extends from Montgomery street to the Bay. The transverse avenue, called East street, which passes in front of the wharves, has also been re-laid and improved by a re-arrangement of the car-tracks, so that the incoming traveler will be impressed by the greater cleanliness and definiteness of this part of San Francisco.

The heart of the old San Francisco, at the meeting of Kearny and Montgomery streets, with the great cross-town artery of Market street, is now adorned by several splendid new buildings. On the southeast corner of Market and Second is the Balboa building; on the corresponding corner a block farther west is the Bank of the Metropolis; at the intersection of Post and Montgomery is the First National Bank. These are fast approaching completion and already add greatly to the appearance of the City. The site of the old brick structure of the Palace Hotel is now surmounted by an 8-story steel framework that, in a year more, will mark the restoration of a caravenserai famous the world over. The St. Francis, on Union Square, has been rehabilitated and a third wing added, so as to improve the proportions and add largely to the capacity of this hotel. The Fairmont was nearing completion in April 1906; it was not injured structurally and now proudly crowns the crest of California hill, occupying a site unequalled for panoramic view. Looking westward from the lower end of Market St., there is now to be seen the prow of the big Phelan building, a triangular structure standing on the gore made by the meeting of Market and O'Farrell streets with Grant avenue. It is a huge structure of 11 stories of steel, covered with cream colored tile, and presenting an appearance likely to remind the traveler of the Flatiron in New York. We give herewith a photograph of this building, as typical of the new San Francisco and as suggesting, by the name of its public-spirited owner, the fight for civic decency that more than many buildings of steel or stone has marked the renewed life of San Francisco. The earthquake shook other things besides the ground under the City, the fire consumed a corruption that was not all physical, the glare of the holocaust threw light on many dark doings. The moral upbuilding of San Francisco may not be as apparent to the traveler from east or west as the architectural rejuvenation, but surely it is the more important. In November last the corrupted and corrupting municipal government was driven out of office by the vote of outraged citizenship, and while much of the slime of a dirty kind of politics is still apparent in many a by-way, there is a better spirit abroad. The "warder of two continents" has set a watch on herself.

The Phelan Building and Market Street. The Flood Building in the Distance. Temporary Structures in Right Foreground.

The Fairmont Hotel.

THE NEW SAN FRANCISCO.

Discussion.

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy.

Yukon Gold.

The Editor:

Sir—Under separate cover, I am sending you copies of the complete reports and statements relative to the Yukon Gold Company. Enclosed herewith, you will find a tabulated statement showing how the total figures are reached.

Mr. Beatty's statement is merely an expression of opinion of the reports submitted to him, based on his personal knowledge of the country. Mr. Beatty made two trips to the Yukon when this business was in the making, and has had the full data before him covering the examination work, construction, and operation.

As to the supplementary report, I can only say that I have found Mr. Treadgold to be a keen and careful observer, and in all the cases where his statements have been checked by our own examination work, they have been confirmed. I personally consider that he knows more about the Yukon properties than any one man. He made a number of investments early in the Klondike excitement and has studied the gravels there for nearly ten years.

As to our own reports of valuation, would say that every property that has been accepted by the company and taken into its holdings, has been examined by our own engineers independently of any reports made us.

As to net results: The proposition has been criticized freely on the ground of impracticability, great pressure being put upon the mechanical difficulties, impossibility of handling frozen ground, etc. I feel that I am entitled to speak with some authority on these points: First, in regard to hydraulicking: With the limited water supply from the small gulches, hydraulicking has been carried on in the Klondike for a number of years, and successfully, wherever dump-room and water-supply were properly provided for. Our own hydraulicking operations on a small scale have shown a profit through two years' operations. We have provided for dump-room by purchase and control of the creek claims. A continuous water-supply during the summer seasons has been a thing unknown in the Klondike district. We have secured our water-supply from the main right fork of the 12-Mile river which, at the lowest stage, insures us a continuous supply of 5000 miner's inches throughout the season. All of the conditions for economical hydraulicking are present. The duty in the small operations previously conducted has been high, and on account of the extent of the deposit and the long faces which it is possible to open, I consider that we shall be able to use our entire water-supply to its maximum efficiency. We have provided, in the laying out of the system, for the application of the water at a number of points both in the creek-bottom and on the hills, insuring by the number of openings the highest possible duty. Taking our present hydraulicking cost as a base with the reductions that can be safely figured to result from a continuous water-supply, I feel sure that the 10c. cost for hydraulicking is a very safe average figure throughout the life of the operation.

Our dredging operations have also been severely criticized by a certain writer for the technical journals. We have realized from the outset the limitations of dredging in the Klondike, and have only installed dredges on the wide open valleys where the bedrock is suitable and on portions of the creeks where the gravel was thawed, or partly so. The dredgeability of the Klondike gravels has been thoroughly demonstrated by the operations of the Canadian-Klondike Co., which is operating a 7-ft. Marion dredge at the mouth of Bear creek, and by our own operations on Lower Bonanza. The Canadian-Klondike dredge averaged 2935 yards per day during the season of 1906, operating from May 9 to October 22. This fully equals, if not surpasses, the duty of a dredge of the same type in the Oroville field. Our own 5-ft. dredges have attained an average of 2000 yd. per day when operating continuously in thawed ground. We have never assumed that a dredge would handle frozen ground. As to the problem of handling frozen gravel: We have conducted a series of experiments extending over two years, embracing stripping the ground by ground-sluicing, thawing by steam points, and using water under pressure. We have never doubted the necessity of having water and plenty of it to prepare the ground for dredging where frozen. The object of our experiments was to determine the extent to which the gravel would thaw after ground-sluicing only, and

TABULATED STATEMENT CONCERNING THE YUKON GOLD GRAVELS.

	Perry.				Treadgold.		
	Yards.	Gross value.	Net value. 32c. for creek. 10c. for hill. Cost per yard.	Net value. 25c. for creek. 10c. for hill. Cost per yard.	Yards.	Gross.	Net.
Total creek gravels	36,450,000	$25,400,000	$11,500,000	$15,000,000	52,000,000	$34,050,000	$24,950,000
Total hill gravels	47,000,000	14,850,000	9,500,000	9,500,000	65,500,000	19,000,000	15,000,000
	83,450,000	$40,250,000	$21,000,000	$24,500,000	117,000,000	$53,050,000	$39,950,000
Probabilities in hill ground partly proven	16,000,000	4,100,000	2,500,000	2,500,000	20,000,000	5,000,000	4,000,000
Additional creek yardage assuming a reduction in working cost to 25c	10,000,000	3,500,000		1,500,000			
Equipment returned in cost as above			4,500,000	4,500,000			
Oroville and Atlin gravels			2,500,000	2,500,000			2,500,000
Allowance for probable extension and reduction in cost				2,000,000			
Grand total	109,450,000	$47,850,000	$30,500,000	$37,500,000	137,000,000	$58,050,000	$46,450,000

to what extent pressure water was necessary. A block of ground on '90-below' on Bonanza, which was completely frozen at the time of my first visit to the country in 1905, was stripped with the aid of a small nozzle under 30-ft. head in 1906 and was dredged in 1907 without the use of an ounce of fuel, the dredge working into the bedrock four to five feet to recover the values, and making an average for the run of 1780 yd. per day, which could have been increased to 2200 by taking less of the bedrock. This block containing approximately 38,400 yd., yielded 50.8c. per yd., at a cost of 24.1c., including depreciation. I cite this as an instance of what may be expected when the ground is properly prepared for dredging. Our thawing by steam points in advance of the dredges actually cost 14c. per cu. yd. and will be reduced to 12c. with our present equipment. The need for tailing-room made it necessary to start the dredges before pressure-water was available, and steam-thawing is our only resource at present. It is expensive, but not prohibitive. With water under pressures ranging from 550 to 900 ft. along the creek-bottom, I am thoroughly convinced that we can put all the ground we expect to handle by this method in condition to dredge for a cost not to exceed 5c. per yard. We will not only strip the moss and muck from the claims but cross-cut them with the giants to expose the frozen gravel, and open the way for the surface water to reach the bedrock. Some thawing with points will probably always be necessary, but it will be reduced to a minimum.

The mechanical elevators are as yet in an experimental stage. Similar machines have been built and operated not only in the Klondike, on Gold Run, but in the Cariboo district, and elsewhere. The machines have been designed with a view to making them strong, light, and portable, all steel construction, and capable of doing the work for which they are designed at a minimum cost. The cost is a pure estimate at present, but we do not expect to exceed 35c. per yd. at the outside, and the gravel to be handled by the elevators is rich enough to leave a large margin of profit at this cost figure. Our dredging cost we expect to reduce to the neighborhood of 20c. after water is available. To attain the above costs, cheap power is a necessity. We have provided for this by installing our own power plant of 2000-hp. capacity on the Little 12-Mile, from which we deliver power to our operations at a cost of not to exceed $3 per horse-power per month, which is much cheaper than the average California power cost.

The dredges in 1907, operating for less than 50% of their possible running time, absorbed over $65,000 in experimental stripping, and thawing charges, as well as the entire cost of operating a large power plant, and still showed a profit. The properties in the Yukon Gold consolidation have earned a net profit of over $300,000 while in the equipment stage where the operation has been confined to very small limits. This does not appear to indicate that the properties have no value.

New York, April 13. O. B. Perry.

[This matter is discussed in our editorial columns. Editor.]

Rawhide, Nevada.

The Editor:

Sir—I read with considerable interest an article in your paper of March 28, entitled 'Notes on Rawhide, Nevada,' by someone who evidently does not desire to sign his name, presenting a very discouraging, and, in my opinion, unfair view of a camp which gives promise of adding its quota in the near future to the already large production of a State which has risen in a few years from a position of comparatively insignificant precious-metal production to the second in the Union, Alaska included, according to the preliminary report of the Director of the Mint issued the first of January, 1908. This amounted to $19,831,214, and would have been much larger except for serious labor troubles.

The same kind of talk and doubt as this article expressed was constantly heard at Tonopah and Goldfield in the early days of those camps until development had demonstrated beyond the peradventure of a doubt the existence of large and highly profitable orebodies, calling the attention of mining men again to the possibilities existing in the porphyry formations where contacts of distinctive rocks like slate and diorite do not exist and where true fissure veins are not found. The vein formations being of the gash or fracture order, the adjacent country rock has been enriched by ascending mineral solutions dissolving out and replacing the country rock along the lines of fracture. Whether these fractures are caused by intruding dikes of a similar rock to the original formation or simply a slipping of one part upon another cannot positively be determined until sufficient depth has been reached to get unaltered rock sections. However, sufficient openings have occurred to form veins of no mean width that extend in quite regular directions for considerable distances. This is conspicuously noticeable on Balloon hill and farther west in the Royal Tiger district. On Hooligan hill and other areas there is an extensive stock-work system, which consists of small seams lying close together and occasionally a larger fracture up to two or three feet in width, all so highly mineralized as to make the surrounding country rock rich enough for profitable milling.

Opportunity cannot be afforded the many who go to a camp such as Rawhide to go through every mine and sample it or even a considerable number, as there are a hundred people going and coming every day to the more important properties, but anyone can see ore panned from the dumps showing a good amount of gold over a wide area of country. I was permitted to go down most of the properties I desired and take such samples as I chose; the results were usually good. For the information of any who would like to know I give the results of Mr. L. M. King's sampling of the Kearns leases, on Balloon hill, and the Miller lease, on Hooligan hill. This work was done for the primary purpose of determining the treatment best suited to reduce the ores on the ground. Mr. King's results were as follows: On the Kearns No. 2 he found a vein, 2½ ft. of which on the hanging wall side gave returns of $5000 in gold and 150 oz. silver. Under this there is 8½ ft. of ore which shows

$54 in gold and 2½ oz. silver per ton. This would make an average of $1300 per ton for a width of 11 ft. This exposure was at 65 ft. in depth, and I do not know where it has been equalled for so small an amount of work done. The last shipment, of about 50 tons, from which returns have been had from this property, which contained but a small portion of this high-grade ore gave results of $198 per ton. The sample of the dump on the Miller lease gave the average of $45 gold and 10 oz. silver; the width of this vein is over 20 ft. The sample that was obtained from the Kearns No. 1 assayed $250 gold and 129 oz. silver, but was not a general sample of the mine but of some of the richer parts, as the vein formation is very wide on this property. As a result of these findings a contract has been let for a 50-ton mill, as a first unit of a 200-ton plant, to be ready to be run in 90 days.

To say that "there is no quantity of high-grade ore opened up in the camp at present" is quite misleading. It may not be 'blocked out,' but it is 'discovered.' It is only, in my judgment, a question of time and some more work to block out sufficient ore to satisfy the most exacting. It takes time to develop any camp, as well as money and faith. Rawhide is too new to have accomplished this yet, but they are going after it pretty strong. Thus, 14 hoists are either installed or being installed and 9 or 10 others are in transit—a remarkable showing in so short a time. The town is at present built ahead of the mines, but this is always the case and Rawhide is no exception to the rule. Considering that this place has come forward at a time when money conditions are tight the world over it has made remarkable progress and is a credit to the energy and pluck of the men who are honestly trying to make another Nevada camp to add more money from out the ground to the channels of trade. They are deserving of all the help they get.

San Francisco, April 12. E. S. Shanklin.

The New Association.

The Editor:

Sir—One of the reasons given for the proposed society of mining engineers is the hope that membership in it will mean something, this I believe will be the dominant issue. The members will be mostly live and successful men, so it is improbable they can meet without technical discussions. Could J. P. Channing and W. R. Ingalls spend an evening together without talking metallurgy, and could they let S. F. Emmons and W. Lindgren off without wanting their latest geological impressions? Would the editor of this paper say "Hush gentlemen, those are forbidden subjects, let us talk about professional ethics, etc., as proposed in my editorial of March 28."

I suppose all the instigators of the association belong to the A. I. M. E., and it is proposed by one or more of them to make future membership also entail membership in the Institute, establishing an affiliation. This would mean a cost of $20 per annum, instead of $10, with corresponding benefits. Then its members could possibly present and discuss papers at their own meetings and give to the Institute for publication, inscribed as read before and edited by the more select society; and the latter could aid in the cost of publication of these papers, thus perhaps sending them out more attractively illustrated.

I want to put in a plea from the rank and file of the Institute for the continued benefit of the teachings of the men who will compose the new order, and if it can be arranged, to get them for the present $10 per year. The Institute does not directly convey any dignity, either to the men who would form the new society, or to those left behind, but I have always thought it a sign of the best endeavor that the young engineers, foremen, millmen, and men simply engaged in mining as a business, joined the Institute. All of them read more or less of the Transactions they can understand, and if there is any paper on a district in which they are interested, there is sure to be a well thumbed copy at hand. These men did not enroll for prestige, but are paying a usually hard earned annual due to learn from the wisdom of their elders.

No honor which the new society may confer on the successful men who will comprise it is begrudged, and I think that most of its members will be broad enough to wish to continue to help the less wise who form the bulk of the Institute. After all, reputation and honor is founded on work known to the masses. Among the many holding the names of Clarence King and S. F. Emmons in respect, how few know of their enrollment among the members of the National Academy of Sciences, which should constitute the most exclusive association in America?

Denver, April 6. J. B. Hastings.

Antimony Ore in California.

The Editor:

Sir—Referring to the price of antimony ore in California in your issue of February 29, I beg to state that the difference between the unit price for ore and that of pure metal shows a margin of $1.80, or 2 tons of 50% ore would cost $60, and the metal contained in same would sell at $240, leaving $180 for treatment, loss, and profit. In England 'Star' is quoted at £35 and 50% ore at £10, leaving £15, or $75, for the smelter. Notwithstanding the expensive cost of treatment, and loss during reduction, a plant should pay well if erected at a suitable spot where regular supplies of ore are available. The losses of antimony, in a well equipped works, should not exceed 10%, and $40 to $50 per ton of refined metal should cover smelting charges. With metal selling at $240 per ton, the formula on which ores were formerly bought in France would work out as follows:

40 to 60% ores.

Price of 'Star'	$240
Deducted by smelter	100
	$140

or $1.40 per unit.

The price per unit paid for ores carrying 10 to 25% antimony is half that for the rich ore, or 70 cents. The difference between the American and English prices, being about $60 per ton, should prove a wide enough margin to pay all expenses.

J. Henry Rickard.

Newquay, Cornwall, March 23.

GOLDFIELD, NEVADA.—I.

Written for the MINING AND SCIENTIFIC PRESS
By T. A. RICKARD.

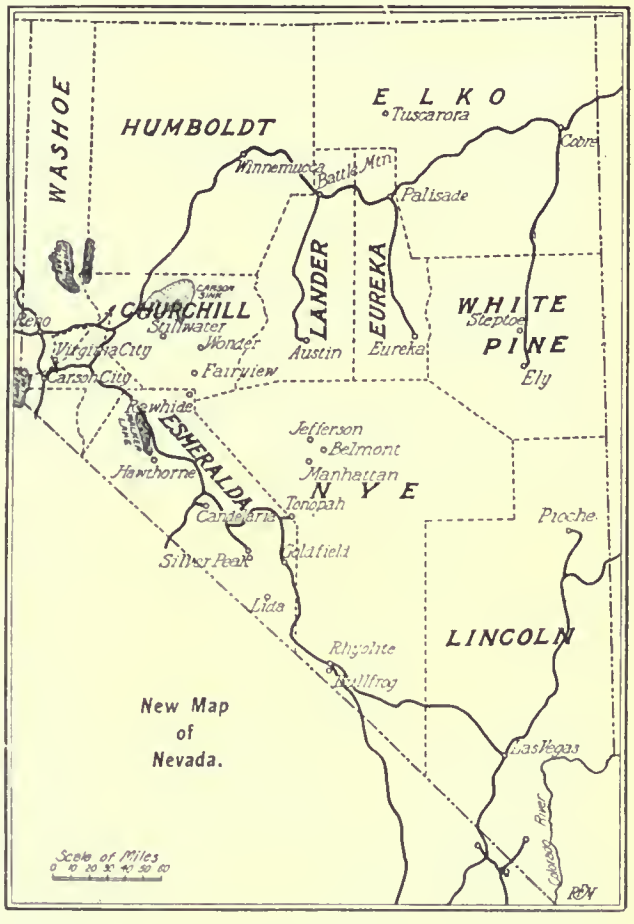
Goldfield has been twice christened. In its very infancy the camp was called Grandpa; this savored of frivolity, so the name was changed to Goldfield. It must have been a spirit of prophetic presumption that led the first discoverers to arrogate for the locality the name of The Goldfield, as if it were the one and only great gold-producing district of the world. But Fate and some fostering star have justified the baptism of the pioneers. Goldfield *is* today *the* goldfield of America.

When Harry Stimler and his partner called the place Grandpa they did not claim that it was the parent of the Mother Lode of California; it was a play on such names as Tonopah, Ivanpah, and Ibapah. These are of Indian origin; *pah* means water. Tonopah is a corruption of Tonumba-pah, which stands for 'water brush.' Iba-pah is red water and Ivan-pah is white water. Thus the Ivanpah range and the Witwatersrand are synonyms, for both mean the 'white water range,' and they sound as unlike as their sponsors, the Indian of the Nevada desert and the Dutchman of the African veldt.

Tonopah not only suggested the first name of the district, it was the parent of Goldfield. When I was in that part of Nevada in the spring to 1899, to make an examination of a copper deposit in the range east of Luning, all this part of Nevada was dead, from an industrial standpoint. Only the decadent glories of the Comstock reminded the traveler that he was in a mineral region once so famous. At Candelaria there was a little mining, and the stage road to Bodie from Hawthorne, up the canyon that led across the State line into California, recalled the excitement of a former era. The country had been abandoned by the prospector. It was one of the has-beens of history. The old trails still left faint lines across the sagebrush desert and over the bare rocky ridges and spoke of a period of strenuous search for gold and silver. Some of those abandoned paths of exploration went close to the places where rich mines have been discovered. The road from the north went close to the present site of Manhattan; in fact, there was an old camp within four miles of the one that sprang into existence in January, 1906. The old road to Montezuma, along which prospectors had traveled for fully 35 years, traversed the big flat east of Lone Mtn., and was within a few miles of both Tonopah and Goldfield. There was a trail that passed within a stone's throw of the Mizpah outcrop, which beckoned the miner for many a long day before Jim Butler thought of testing the black rock.

Like navigators that pass a treasure island in a fog and hear the muffled roar of the breakers only as a warning of danger, so these old prospectors went past the hungry-looking outcrops of silicified rock, never dreaming that they capped the wealth they were seeking with such invincible restlessness.

The first discovery in this region was made at Southern Klondike, a place half-way between Tonopah and Goldfield, which are 24 miles apart in a straight line. This first discovery was made by James Courts in 1898. The name suggests contemporaneity with the great rush to the Yukon. The outcrop of the Tonopah lode was plainly visible to those who went near it; in fact, Courts says that he and his partner used to go over the trail through the Mizpah pass and they employed the cropping of the Mizpah (or Tonopah) vein to shelter their campfire from the wind. At that time Jim Butler was at Belmont. In 1900 he made a trip from Belmont to Southern Klondike, and on his return he tried to make a short cut and so happened to tramp over the site of Tonopah. He saw the outcrop and picked up some pieces of the broken vein, taking them to Southern Klondike, where there was an assay-office run by on old man named Frank Hicks. This assayer threw the samples away, saying that he would not give a



dollar for 1000 tons of such stuff. Butler jokingly offered him a quarter interest for an assay. The ore was full of the black sulphide of silver (argentite) and anyone familiar with silver ores would have known that it was tremendously rich. These gold prospectors were ignorant concerning the other precious metal, so they blundered like tenderfeet.

On his way out Butler got some more of the black mineral and took it to Belmont, where he gave it to T. L. Oddie, who happened to be there in connection with the operation of a quicksilver mine. Oddie was an educated man and was then the District Attorney of Nye county; he lived at Austin, where he had been for several years as representative of the Stokes interests. Oddie sent the specimens to Walter C. Gayhart, an assayer at Austin. Butler promised Oddie a quarter interest, and Oddie promised Gayhart a half of his quarter—all for the making of an assay! Money was scarce; they were all of them 'busted.'

Gayhart's assays showed that the selected specimens ran from $300 to $400 per ton. Oddie thereupon sent an Indian runner to Butler's ranch, which was 45 miles from Belmont, to tell him of the strike; but Butler remained inactive. He was reputed to be "the laziest white man in the world." Even his location monuments are indicative, for they are built of seven or eight stones at the most. He never did a stroke more than necessary, if as much. Meanwhile Gayhart spoke publicly of the discovery and several men left Southern Klondike with the idea of finding it; but they failed. Three months after the assay had been made, Butler went to Belmont; he arranged with Oddie and Wilse Brougher (the recorder for Nye county) to make a trip to the scene of discovery. They gathered the necessary supplies at a cost of $25, which was about all they could scrape together. This was in August, 1900. On arrival at the spot, they located seven claims and then started to work. A small shipment was taken away in their spring wagon. This lot of ore was selected stuff and weighed slightly more than a ton; it was hauled all the way to Eureka, 170 miles distant. The partners received $600 as the result of that first shipment. Thereupon, in October, they started to lease the ground they had located, dividing their claims into blocks of 100 ft. square, to be mined on a royalty of 25 per cent.

When Hicks, the assayer at Southern Klondike, heard of the find, he picked up the specimens he had thrown away and assayed them. Then he claimed a quarter interest, and the matter was finally adjusted by Butler donating him a $^1/_{32}$ interest. He had no legal, nor even moral, right to share in the discovery. Butler's action was generous—generous as the spirit of the West, and of the pioneer the world over.

On June 3, 1901, only seven months after work had begun, the property was bonded by O. A. Turner for $337,000, of which $50,000 was paid at once and distributed, according to their holdings, to the five owners, namely, Oddie, Butler, Brougher, Gayhart, and Hicks. Turner drew at sight on his friend and associate John W. Woodside, of Philadelphia, a snuff manufacturer. In this deal Turner was assisted by J. H. Anderson, who became the first president of the Tonopah Mining Company of Nevada, which was organized with a capital of $1,300,000, of which $1,000,000 was in common shares of $1 each and $300,000 was preferred stock carrying 8%, the latter being subject to recall at any time. One share of preferred entitled the subscriber to two shares of common stock. The common stock rose eventually to $22.50, so that several fortunes were made and lost before it fell to its present price of $8. The mine never needed any working capital, it was a profitable enterprise from the very start. Before the leases expired on the last day of 1901 they yielded $3,000,000 worth of ore. Up to the end of 1903 the mine yielded $5,576,000, of ore averaging $160 per ton. In the following January the late William C. Whitney, the New York traction promoter, bought Woodside's 280,000 shares for $7, and a few months earlier John Anderson sold his smaller holding to a group of Philadelphia men headed by John W. Brock and W. L. Elkins, who was a director at the time of his death. Brock retained his shares and became president, retiring a few months ago. In order to diminish operating expenses, a railroad 60 miles long was built by the Tonopah Mining Co., so as to connect the mine with the Carson & Colorado railroad, a narrow gauge line running south from Reno. Construction was begun in January and the road was completed in May, 1904. In 1905 the railroad gauge was widened to the standard, so as to correspond with a similar change on the branch of the Southern Pacific, with which it connected at Sodaville. This railroad enterprise proved highly profitable for a time and was managed so as to be more remunerative than the mine itself. It aided the development of Goldfield, to which we now return.

By his share in the Tonopah mine, Jim Butler thus became rich and the patron of other prospectors. At the end of 1902 he 'grubstaked' or outfitted Harry Stimler (a half-breed) and William Marsh, two young fellows of Tonopah about 20 years of age. They went south and found rich float on what is now Columbia mountain, which overlooks the site of Goldfield. After searching in vain for the source of the rich float, they prospected northward and found gold in the surface dirt. Thereupon, the Sandstorm was located on December 2; the name of the claim suggesting the state of the weather at the time. The Kendall was located immediately afterward. In both cases free gold was found in the débris of disintegrated rhyolite and this led to a brief excitement, but no large orebodies were uncovered and the interest of the neighboring prospectors soon waned. In the spring following a party of Tonopah men sent a couple of prospectors to the new camp, then called Grandpa, as already stated. The prospectors were A. D. Myers and Tom Murphy. They located the Combination on May 24, 1903. Here let me relate a typical tale of hard luck. R. L. Johns, a lawyer then residing at Tonopah, happened to go into a store and was told by the proprietor that a pool or syndicate was being made for the purpose of sending a couple of prospectors to Grandpa. Would he take a share? It would cost $50 at once, with $50 more to be paid later. Johns said he guessed he would, and later in the day he returned with the money, only to be told that he was too late, another man having subscribed for the share. Johns did not bother about it, until he ascertained that the other fellow had subscribed his $50 with the $50 Johns had himself lent the other fellow the day before. So the reader can imagine the feelings of Mr. Johns when the prospectors found a good lode, which became the basis for a big mine, and one-twelfth of it had been secured by the $50 lent to another man who had jumped in and subscribed for the share our legal friend had expected to take.

At the time the Combination claims were located, no ore had been found. Tom Murphy, who was one of the discoverers, says that he located the Combination because it was the vacant territory nearest the Sandstorm; all the ground south from the latter had been located. Moreover, there was a large outcrop of quartz rock on the Combination, but that did not

mean much, for there were many similar combs of silicified material rising above the desert all around Columbia mountain. Myers, who was Murphy's partner, made a cut near the top of the hillock because there the detritus was thin; he found a stringer carrying gold in the midst of a mass of barren quartz. This stringer panned nicely and assayed as high as $83 per ton. Then he went down the side of the ridge and drove a short tunnel, which cut the lode at 20 ft. below the surface. He found good ore. This led to the big orebody now marked by the cavernous pit named the 'glory hole.' In the following October the Combination No. 1 and 2 claims and eight other locations were bonded by L. L. Patrick, acting for Arthur Winslow and J. D. Hubbard, who were trustees for two exploration companies. The ground was bonded for $75,000, of which $5000 was cash. This $5000 was the only money ever required, for the remaining payments were paid, as they became due, out of royalties on ore mined by successful lessees. On March 1, 1907, the Combination mine was sold to the Goldfield Consolidated Mines Co. for $4,000,000. In the previous 25 months the Combination had yielded $786,000 in profits to the owners, besides enriching many lessees. So ended a most profitable mining adventure; and it is pleasant to relate that among the beneficiaries was a scientific geologist and mining engineer, for Arthur Winslow was State Ge-

North end of Town. Frances Mohawk. Lone Mtn. Hayes-Monette Lease. Nevada-Goldfield Reduction Works. Mackenzie No. 1.

Combination Mill. Combination Fraction. Baby Florence No. 2. Railroad to Bullfrog. Mohawk. Combination Fraction. Winston Lease.

ologist of Missouri before he applied his technical training to the exploitation of a bonanza.

The early discoveries made in the Goldfield district gave no indication of the marvelous wealth it was destined to produce. The first find, on the Sandstorm, was bunchy and close to the surface of the rhyolite, which occurs in thin flows. This yielded fully $500,000. On the Kendall claim, which is partly in the same rhyolite and partly in tuffs associated with them, the surface dirt was rich, forming a concentration due to wind action; it was an eolian placer. When deeper mining began a vein was found several feet wide and profitable down to 30 or 40 ft. More recently renewed exploration has resulted in the discovery of a good width of ore at 70 ft., the gold being remarkably free. Another patch of gold-bearing débris was found on the Velvet, half a mile east of Columbia mountain; also in the rhyolite on the Cimarron claim. All of these patches of rich stuff—the cream of the geological dairy—stimulated prospecting and led to tentative digging into the combs of iron-stained quartz and silicified rock that appear on the sagebrush plain south and east of Columbia mountain. In two cases only was any noteworthy ore uncovered. There was the stringer that Myers found on the Combination and there was the outcrop on that part of the Jumbo subsequently included in the Bowers & Kernick lease. On this spot a defined vein was found within the 'blow-out' or comb of silicified dacite. A stope now breaks through the surface, and most of the outcropping mass for about 20 ft. in width will assay $20 to $25. But there was nothing to indicate the presence of the wonderful orebodies of the Mohawk mine; in places there were combs of silicified dacite shading into quartz that bobbed to the surface from under the detritus, due to erosion and wind action, but this stuff did not show gold in the pan and was neglected by all the early prospectors. The great bonanza might have remained locked in the heart of the desert if the developments in the Combination mine, which is on adjoining ground, had not stimulated the sinking of shafts in search for 'impossibilities,' as a local geological authority of German extraction, calls them. But they found the golden ore, rich beyond the fondest dreams of avarice, wonderful beyond the expectation of geological vision, and in quantity enough to turn a dozen good fellows into ordinary millionaires, as will be related in the sequel.

Manufacturing as Compared With the Reduction of Ores.—In a manufacturing establishment the buying of supplies presents no special difficulty, while the sale of the product needs skill—sometimes of the highest—and even then at a sacrifice of profit. A mine reduction-plant may be considered to have no anxiety regarding its principal supply of ore, or, at least, if the supply is not forthcoming, it is helpless; on the other hand, its product is easily sold at the market quotation, at any rate, to the metals selling companies. A custom reduction-plant needs skillful buyers, who, with good money in their hands, make every endeavor to procure ore, and sometimes fail to get it in sufficient quantity or quality.

The Prospector.

Owing to the large number of specimens forwarded to this department, it has been found necessary in future to make a charge of 25 cents to subscribers for each determination, and $3 to non-subscribers.

M. F. B., of Boston, Mass., sends a specimen of serpentinized rock containing pyrite.

The metallic mineral in rock sent by R. L. H., of Wardner, Idaho, is galena. No tellurium is present.

Rocks from Wallace, Idaho, marked P. 10, are: No. 1, quartzite with specular hematite; No. 2, quartzite.

G. G. C., of Schurz, Nev., sends: No. 1, quartzite; No. 2, quartz porphyry; No. 3, limestone with gypsum veins; No. 4 and 5, quartz.

The specimens sent by E. I. F., of Baker City, Oregon, are gneiss, the larger piece containing much pyrrhotite and some veinlets of pyrite.

A specimen of porphyritic rock which may be classed as quartz-porphyry or rhyolite-porphyry was received from M. T. C., of Red Mountain, Colorado.

Minerals from Tacopa, Cal., sent by K. & L., are: No. 1, calcite; No. 2, resembles magnesite, but is a silicate of alumina, magnesia, soda, and some lime. Probably a variety of amphibole.

Gold and Silver in Thermal Springs.—Interesting evidence on the origin of gold and silver in quartz veins is given by certain hot springs in the centre of existing hydrothermal activity in New Zealand, the Taupo volcanic zone. Sinter taken from the rim of a very ebullient spring at the Maori settlement of Whakarewarewa was found to contain, on analysis, silver to the amount of 4 oz. 18 gr. per ton, and gold to the amount of 1 dwt. 4 gr. per ton. The sinter analyzed was stained with sulphur, but showed no visible evidence of any sulphides. Analysis made from the sinter deposited in a wooden trough used to conduct water from the same spring at Whakarewarewa gave the following result in the precious metals: Gold, 12 gr.; silver, 15 dwt. 3 gr. per ton. The great geyser of Waimangu, which broke into action some years after the terrible Tarawera eruption of 1886, and remained active until November, 1904, deposited a blackish material, consisting chiefly of sulphides, but containing neither gold nor silver. Some mud obtained by Dr. Wohlmann, the Government balneologist, from a hot spring in the sanatorium grounds at Rotorua gave the following somewhat remarkable analysis: Silica, 69.30; alumina, 4.52; iron oxides, 2.00; titanium oxide, 0.58; lime, 1.00; magnesia, 0.10; soda and potash, 1.30; sulphur, combined, 1.40; sulphur, free, 6.09; organic matter, 10.01; water, 3.70%. Microscopic examination of the deposit showed that it consisted mainly of quartz and amorphous silica with a little feldspar. The mud also contained 5 gr. gold and 6 dwt. 1 gr. silver per ton. It is evidently not a deposit from the spring, but is merely a siliceous tufa impregnated by the thermal solutions.—J. Mackintosh Bell in *The New Zealand Mines Record.*

THE SEPARATION OF SLIME IN CYANIDE TREATMENT.

Written for the MINING AND SCIENTIFIC PRESS
By HORACE G. NICHOLS.

The process herein described first suggested itself in connection with the dewatering of tailing at a property in Central America. At this mine a partial draining of the tailing was resorted to in ponds, and the re-handling and transportation of the partly dried tailing to the cyanide plant was unsatisfactorily performed by an unreliable class of native labor. The cyanide plant was frequently closed by reason of inability to handle the tailing, and thus the great need of an efficient method of separating solids, however finely divided, from water, gave rise to experiments with a settling tank and conveyor belt. Two facts were soon noted: first, the great influence upon the rate of settlement of slime in water produced by removing the solids as they settled, and second, the applicability of the method in cyanide treatment. The first of these points was discussed in a paper recently read before the Institution of Mining & Metallurgy.

One of the principal causes which retards the settlement of slime or finely divided material is held to be, in greater measure than has heretofore been appreciated, the accumulation of the slime itself in process of settling. By avoiding such accumulation, free settlement of the solid particles is obtained. The principle involved is that of removing solid matter as fast as it reaches the bottom of the tank in which it is settling. The effect is that the solid matter settles very compactly if not allowed to accumulate, and its removal prevents the thickening of the liquid above. To quote from Julian and Smart, 'Cyaniding Gold and Silver Ores,' p. 219, "Retardation is a function of the depth measured from the top of the still turbid portion of the liquid to the bottom of the vessel," and "An increase of suspended matter causes a decrease in the rate of subsidence." If then the solid contents of a pulp-charge were removed as they settled, or in other words, if there were no bottom, in the sense implied, to the settling vessel, then this factor of retardation would be eliminated, the increase of density would be avoided, and the continued settlement of the slime would be unimpeded. The logic of this principle of free settlement, which implies this elimination of the retarding effect due to an increase of density in the medium during settlement in a closed vessel by the accumulation of the slime itself while settling, may perhaps not be perfectly clear, but the experiments carried out will, it is believed, establish the fact.

The retarding effect of the thickening of the medium on the falling of fine particles in water was shown by taking two equal portions of the same pulp and introducing them respectively into two cylindrical graduates, one of which was empty, and the other partly filled with water. The relative rates of settlement were as stated in Table 1. This shows in the case of graduate B, in Fig. 1, that even after the settled pulp had acquired the same consistence as that in the initial condition in graduate A, the rate of settling continued to be greater than was the case in graduate A, and it is suggested that this fact may have a bearing on the extremely compact nature of the slime deposited under these conditions.

A further step may be made by comparing the rate of settlement of a charge of pulp in a vessel closed in the first place at the bottom and in the second place connecting with a second closed vessel

TABLE 1.

50 c.c. PULP DIVIDED BETWEEN (SP. GR. 1.39)

Graduate A (empty).		Graduate B (containing 60 c.c. water).	
Settled.		Settled	
Min.	c.c.	Min.	c.c.
0	50	0	110
10	47	10	85
20	44	20	73
30	41	30	62
40	38	40	52
50	35	50	44
60	33	60	38
70	32	70	36
80	32	80	35

filled with water and placed below it. In the apparatus shown in Fig. 2 the lower vessel and connecting tube were filled with water up to the stop-cock

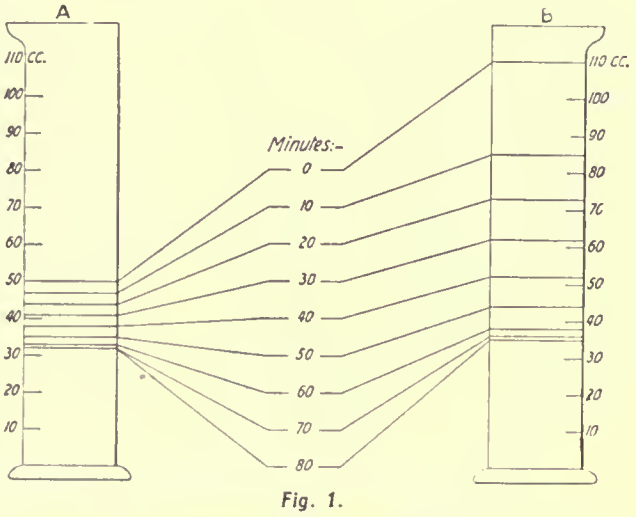


Fig. 1.

C, which in the first place was closed. A charge of 800 c.c. of pulp having a specific gravity of 1.544 was placed in the upper vessel and allowed to settle. In 90 minutes this charge had settled through a distance of 46 mm. leaving the supernatant liquid clear, the turbid portion measuring 154 mm. The upper vessel was then emptied and a second similar charge introduced, and the stop-cock C opened. In 45 minutes this second charge settled through 46 mm., the same distance as before. In 70 minutes it had settled through 114 mm., and in 90 minutes only clear liquid was left in the vessel.

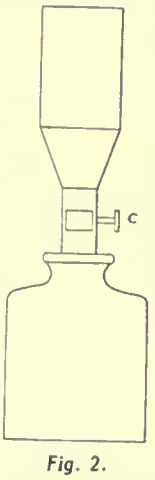


Fig. 2.

If in place of providing the lower vessel as a receptacle for the settling slime, such slime was removed as fast as it settled by a conveyor belt traveling under the upper vessel, the same result would be produced, in that the specific gravity of the medium is not allowed to increase toward the bottom, and

the settling is thus accelerated in the same measure. These results are held to accord with the noted acceleration in the settlement of slime in distilled and hot water, due, it is believed, to the reduced density of the medium, and they tend to show the marked effect on settlement produced by small variations in specific gravity.

Some interesting work recently carried out in South Africa has demonstrated the fact that a variation of a few degrees in the temperature of solution used in cyanide work produces a marked difference in the time required for settlement of slime. The difference in specific gravity due to this variation in temperature is of course quite small, and it may be objected that, in itself, it is out of proportion to, and cannot account for, the results. It is, however, contended that the experiments here described indicate a far closer connection between the variations in density of medium and the rate of settlement than has been understood to exist, and it is suggested that there is a wide field for investigation before it can be stated what is in proportion, or out of proportion, to achieved results. Much interesting and useful information has also been published in connection with the settlement of colloid slime, the electro-static condition of slime particles, the conditions of ionization, etc., and there is no doubt but that such conditions affect settlement. It is, however, suggested that the results of the experiments conducted during the past two years afford grounds for believing that a more important factor is to be found in the principle enlarged upon in this article.

The experiments were made in British Columbia on an ore of quartz, with argillaceous material, containing about 2% sulphides of iron, zinc, and lead, and particular care was taken to separate the heavier and coarser portions from the pulp to be used, by crushing in a stamp battery, with high discharge, and by passing the pulp through a hydraulic classifier. The overflow from this classifier was used in making up the charges, and contained 86% of material which passed 200-mesh (I. M. M. standard dry screening). An apparatus shown in Fig. 3 consisted of a pyramidal shaped tank about 4 by 5 ft., connecting at the bottom through an 8-in. square aperture with a closed box in which a 10-in. belt was made to travel slowly, power being supplied to the head roller D. The tank was provided with a trap door just above its connection with the box B, and this door could be removed from above as desired, thus allowing free passage between the two vessels.

In conducting the tests described, a charge of pulp representing a charge from an agitator was run into tank A, and trough B was filled with water to the same level. While all the pulp was still in suspension (air agitation being used) the trap was removed and the belt run in the direction indicated by the arrows at a speed averaging 4 ft. per min. The removal of the solid matter from the belt was effected by a scraper, in order that each individual 15-minute discharge might be weighed separately for percentage of moisture.

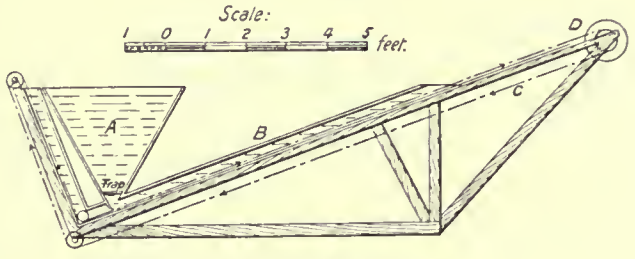


Fig. 3.

Table 2 represents some results from one series of tests out of a great number made with this and a previous appliance, in which the belt was much larger in proportion to the tank, and they show the character of the wet slime discharged by the belt in consecutive periods of 15 minutes. It was found that the finest slime was carried out of the tank and discharged by the belt.

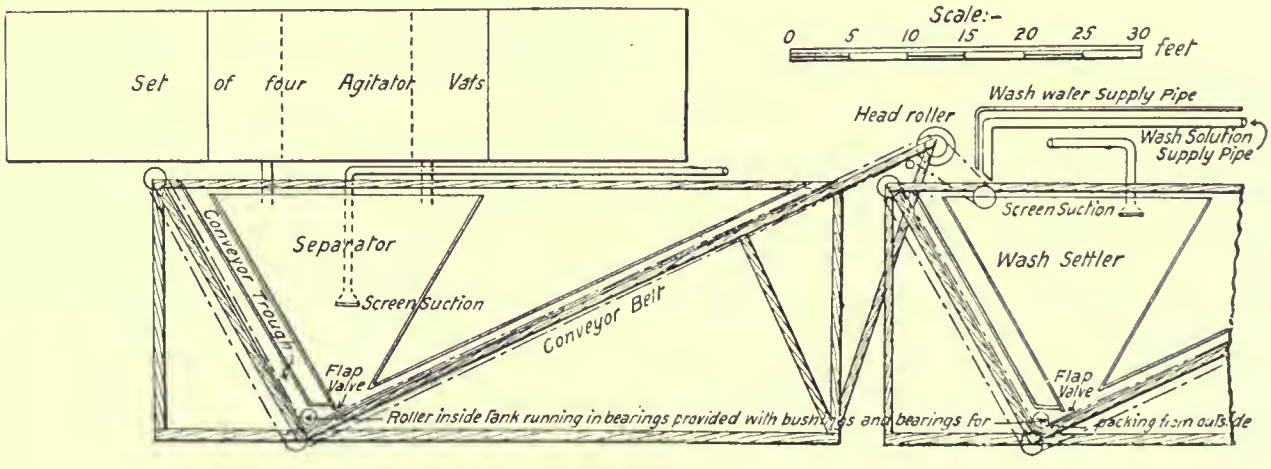


Fig. 4.

In preparing the tables of results it was found convenient to estimate the percentage of solid matter in the discharge by determining the specific gravity, having that of the ore known, and calculating from the formula,

$$P = 100 \frac{S(A-1)}{A(S-1)}$$

where A is the specific gravity of the pulp, P the percentage of dry slime in the pulp, and S the specific gravity of the dry slime. Checks were made on a number of individual charges by evaporation to establish the correctness of the calculations, and in view of its admittedly astonishing character the

whole of the discharge from charge No. 6 (898 lb.) was dried and weighed.

A series of successive charges was run, in which each succeeding charge was added to a residue from a previous one. It was found that the fine slime did not tend to accumulate in the tank and under the belt, and the latter was found to move with such little power that friction was evidently very light. In another series of charges the last traces of slime were removed by the belt in each instance, and it will be seen that the average discharge of a finely crushed ore in the case represented did not contain over 25% moisture, including the finest slime, which was recovered completely from the water, while from a pulp containing 40% solid matter the initial discharge carried but 22.5% moisture. Such a discharge is more comparable with that of filters than with the product of settling tanks.

The apparatus adapted to practical working conditions, with original separating vat followed by a wash vat from which the pulp is separated in the same manner is shown in Fig. 4.

The number of new devices for filtering slime which are now before the mining public is evidence of the difficulties attendant upon the simple method of settling and decantation still largely employed. The two greatest objections to the simple settling process are, the time consumed, and the large percentage of liquid left in the slime even after the most perfect settlement obtainable in the ordinary pointed tanks. The method of settling here described has given remarkable results both in the completeness of the separation effected and in the small proportion of liquid carried off by the solid matter. The process may be applied in one of two ways: first, it might be used as an intermittent process in which a charge of pulp from an agitator vat would be run direct to a separator (see Fig. 4) which would be of sufficient capacity to hold the whole of such agitator-charge in addition to a residual charge from a previous operation. The object of this would be to allow of extracting on the belt only such proportion of the solid content of a separator-charge as could be effected with the economic minimum of moisture. The belt-discharge from this separator would be delivered into a second similar tank, with the addition of weaker solution or wash water or both, and the liquid so added could be sprayed on to the discharging belt so as to loosen and disintegrate the discharged slime, or a mixer might be added for this purpose.

After withdrawal of the required portion of the solid content and clarification of the solution left in the tank, the latter would be withdrawn, either by decantation or by suction, to the original level, thus permitting the introduction of a second charge. A third wash settler may also be used. Secondly, this method may be applied as a continuous process by the simple introduction of a suction and filter.

It is found that the percentage of moisture carried over in the discharge varies inversely with the percentage of solids in the separator-charge, and the first portions of a discharge from any given separator-charge are always better than the succeeding portions, hence we arrive at the fact that if the density of a separator-charge be maintained at its initial density the percentage of moisture in the discharge would be kept at a minimum and the rate of discharge materially increased. Further, it has been found that if provision be made for keeping a filter or screen surface free from accumulated caked slime, which has been done by providing an automatic periodic cutting-off of the suction applied to such filter or screen, and applying a small back-pressure, that it is possible to continually withdraw clear solution from a pulp having a specific gravity as high as 1.4. If the belt and suction then be so correlated with regard to a given supply of pulp that while the one removes the solids the other takes out the proportionate amount of solution, it is evident that a continuous supply of pulp can be kept running to the separator, which would then always contain a charge of uniform specific gravity. Thus it is apparent that the initial discharge from charge No. 6, containing 22.5% moisture, would be representative of the uniform discharge obtainable from a supply of pulp of the specific gravity stated.

Were it not that the solid constituents of the pulp

TABLE 2.

CHARGE NO. 6.

Sp. Gr., 1.345. 40% solids.

DISCHARGE.

Min.	Wet wt., lb.	Wet wt., %.	Sp. gr.	Total sp. gr.	Dry wt., lb.	Total, %.	Moist., %.	Totals. Dry wt.	Totals. Per cent.	Totals. Moist., %.	Travel of belt, ft.
15	127.75	14.20	1.965		99.00	17.24	22.5				125.5
30	151.25	17.16	1.935	1.962	117.20	20.40	24.0	216.20	37.64	23.30	191.5
45	128.00	14.20	1.805		89.50	15.80	30.0				187.5
60	87.25	9.70	1.780	1.879	60.25	10.50	31.0	365.95	63.74	26.40	214.0
75	62.25	7.00	1.755		42.00	7.31	32.5				205.0
90	45.25	5.04	1.660	1.846	28.25	4.92	37.5	436.20	75.97	27.90	222.0
105	29.50	3.30	1.640		18.15	3.16	38.5				154.5
120	22.50	2.50	1.640	1.817	13.85	2.41	38.5	468.20	81.54	29.30	127.5
135	18.75	2.20	1.830		11.45	1.99	39.0				124.0
150	15.75	1.70	1.815	1.817	9.45	1.64	40.0	489.10	85.17	29.30	116.0
165	13.25	1.50	1.560		7.50	1.32	46.5				112.0
180	11.75	1.31	1.550	1.806	6.50	1.13	44.0	503.10	87.62	29.80	104.5
240	38.75	4.30	1.550		21.70	3.78	44.0				475.0
300	38.75	4.30	1.505	1.776	20.50	3.57	47.0	545.30	94.97	31.30	388.0
360	21.75	2.42	1.500		11.30	1.97	48.0				230.0
420	19.25	2.14	1.482	1.758	9.85	1.72	49.0	566.45	98.66	32.20	559.0
480	3.75	0.41	1.400		1.69	0.29	55.0				201.0
510	1.75	0.20	1.100	1.756	0.79	0.14	55.0	568.93	99.09	32.30	98.5
600	57.88	6.43	1.060	1.685	5.20	0.91	91.0	574.13	100.00	36.07	
	898.13	100.00			574.13	100.00					

are being extracted by the conveyor belt from the bottom of the vat, the continued use of screen suctions would, of course, not be possible, but by this method it is only necessary to adjust the relative capacities of the belt and suction in order to provide an absolutely continuous process of separation. Practically the same course of procedure obtains in the wash-settlers. The discharge is washed off the belt by precipitated solution and water, and the suctions arranged to withdraw an equal amount of solution. This solution is passed through the extractor boxes and returned from the sump. It may be noted that in other processes the completeness of washing is dependent upon time and the capacity of the plant, inasmuch as each instalment of slime is taken separately and washed solution passed through it as long as it is economically possible to do so, after which such instalment has to be removed, whether perfectly washed or not, to make room for the next succeeding instalment. In this method continual progression through the plant is unimpeded, and the slime may be washed with any reasonable amount of weak solution desired, without in any way affecting the time of treatment, the only factor affected being the capacity of the extractor-boxes.

Among the advantages of this method, it should be noted in the first place that the conveyor belts take the place of other means of transference, such as pumps or carrying machinery used in other plants for filtering slime, and that all other appliances and mechanical contrivances are done away with, as gravity alone performs the separation by reason of the possibility of taking advantage of the principle of free settlement. It will be seen furthermore that the separation of sand from slime is not called for, and consequently the many disadvantages attendant upon methods which depend upon close classification are obviated. It is also possible to wash to the best advantage, and thus reduce the loss in residual moisture by cutting down its value per ton as well as the amount.

Instances have been known in which fine grinding has been carried to an excess in order to make vacuum filtering possible. In this process of separation, where the degree of fineness or uniformity is wholly immaterial, the demands of extraction alone are the criterion of grinding. The initial cost is very low, and the adjustments are simple and easy to make. The best results have been obtained from charges containing high percentage of solid matter, and it may be claimed that the only limit to the thickness of a charge is the point at which it will not run. This feature is of great importance, as it is only required to run the charge from the agitator to the first separator, and therefore greater opportunities are afforded for preliminary decantation and thickening of the agitator charge. Finally, it possesses the great advantage of being a continuous process.

Petroleum at Virgin City, Utah, was encountered at a depth of 566 ft. It is a light grade of asphalt-base oil, testing 22° Beaumé. There is a relatively large quantity of sulphur in the form of hydrogen sulphide, which can be easily eliminated by steaming.

HEAT OF FUSION OF SILVER-LEAD BLAST-FURNACE SLAG.

Contributed to the MINING AND SCIENTIFIC PRESS
By L. S. AUSTIN.

The slag was of the composition SiO_2 33%, FeO 28.5%, and CaO 25.7%. The results were as follows:

	Number of experiment.	Pound-calories.
	1	314
	2	300
	3	310
From pot at furnace,	4	314
" " " "	5	296
" " " "	6	300
" " " separator,	7	335

The last result indicates that the slag when poured into the separating furnace absorbs heat. Comparing two furnaces, No. 3 and 4, there was found at No. 3 furnace: Experiment No. 1, 295 lb.-cal.; No. 2, 291; and No. 3, 300; while at No. 4 furnace, where the slag was not reducing as well, and where it stood longer before making the test: Experiment No. 4 showed 266, and No. 5, 280 lb.-cal. Seven other concurrent results give an average of 298 lb.-cal. We can say accordingly that under normal conditions the total heat of fusion may be taken at 300 pound-calories.

The experiment is thus performed: Into a felt-covered bucket is put a weighed quantity of water, say 15 lb. A ladle receives a portion of the molten slag as it runs from the furnace and two or three pounds is poured promptly into the water, granulating the slag. The water and slag together in the bucket are stirred with a stick, while the rise in temperature is noted by means of a delicate thermometer. The water before the experiment should be at a temperature below the surrounding air of one-half the actual rise of temperature of the water.

A new precipitation process for gold and silver from cyanide solution invented by P. de Wilde of Geneva, Switzerland, consists in acidulating the solution, thus setting free aurous cyanide (AuCy), and hydrocyanic acid. The AuCy is then caught and precipitated in intimate mixture with cuprous cyanide (Cu_2Cy_2), which is formed by stirring into the solution cuprous chloride (Cu_2Cl_2) dissolved in a strong solution of common salt. The Cu_2Cy_2 may be dissolved out of the mixture without decomposition by the use of dilute HCl. The resultant solution, containing HCl is used in the double function of neutralizing more fresh solution and of precipitating the AuCy. After precipitation of the gold cyanide, the acid solution contains free hydrocyanic acid, representing about 90% of the alkaline cyanide originally present. This is regenerated as sodium cyanide by adding a slight excess of caustic soda. The insoluble residue of gold cyanide (AuCy) left from the treatment of the precipitate with dilute hydrochloric acid is dried, roasted, and melted. A point of importance to be observed in the acidulation of the auriferous cyanide solution is that after adding a quantity of the stock HCl solution, with its dissolved Cu_2Cy_2, the Cu_2Cy_2 will remain in solution in the excess of alkaline cyanide. Sulphuric acid is then added, which precipitates the aurous and cuprous cyanides simultaneously.

TENDENCIES IN THE STUDY OF ORE DEPOSITS.

By Waldemar Lindgren.

*We know full well that this is an age of specialization and specialists. Fortunate indeed is he who is in full mastery of the principal features of all branches of his science and who can give his time to broad general questions, such as, in geology, the life history of this planet, the origin of its continents and mountain ranges. It is perhaps true that we have too few men who can devote themselves to such broad work and thereby obtain a wide and undistorted perspective. But the fact remains that most of us must specialize, must try to advance our science in our small way, the only way which we can adopt, to push our little special branch farther into the unknown.

In the study of ore deposits one of our chief aims is to trace the laws of migrations of metals, and of transformations of minerals. These theoretical aims are indissolubly connected with practical questions. The miners who utilize our work are very likely to put this question to us: "We read with much interest what you say in regard to the genesis of the deposit and its manner of formation, but, coming down to the point, what we wish to know is: Where are our orebodies; to what depth can we hope to follow them; how shall we find them if they are lost?" This strong utilitarian tendency follows us throughout our work, and undoubtedly the study of the ore deposits has suffered in some cases by being too closely connected with exclusively practical bureaus. Under such conditions the investigator of ore deposits, as Ransome has put it, is in danger of becoming a geological engineer.

The study of ore deposits was first inaugurated and put on a scientific basis in Germany, and that country has ever since maintained its proud position as one of the leaders in advanced thought. In the United States, aided by generous appropriations from Federal and State sources, and, on the other hand, by the existence within our borders of a series of mineral deposits remarkable no less for extent than for variety, the study of ore deposits has ever found a congenial place, and, it must be admitted that at the present time we stand at the head of the nations in extent of practical and theoretical investigations. We are also fortunate in possessing a body of mining engineers with sufficient geological training to appreciate and describe what they see. Germany undoubtedly comes next in general activity, though here the advance appears to be less due to State aid and to extensive work undertaken by government bureaus than to individual workers, generally those occupying chairs at the many German universities. The field in Scandinavia is not as broad as that of the United States, and is in fact largely confined to deposits of iron ores and to pyritic deposits, but nevertheless Sweden and Norway have always held a prominent place in the study of mineralogy and ore deposits. In Austria and Hungary also are some able men advancing the work. In France and Italy there are comparatively few workers, perhaps only two or three of note in each of these countries, but they make up in their earnest and successful work for the lack of numbers. Considering the world-wide interest of England in the mining of precious metals throughout the world it seems rather singular that so little attention is being given to ore deposits by the geologists and engineers of that country. It is true that there are notable exceptions to this, but with English mining engineers working in the most remote parts of the world it seems as if their contributions to the science of ore deposits is disproportionately small. On the other hand, the English colonies and dependencies have ever interested themselves deeply in the study of ore deposits. In Australasia and Canada a great deal has been accomplished, and many valuable reports are contained in the records of the State survey. In Latin America, Mexico has taken the lead formerly occupied by Chile. American and German investigators have produced notable results in Brazil and the Argentine Republic. Even Peru has awakened to the necessity of a geological study of its ore deposits, as shown by many recently issued bulletins.

It is not necessary for me to enlarge upon the great advance in the study of ore deposits which has been effected by the application of microscopic study of the rocks and ores. I think it is fair to say that great progress has been made during the last years in the universal appreciation of the necessity of such microscopic study and the unreliability of observations which are not supported by such testimony. Aside, however, from numerous studies of minerals peculiar to ore deposits no new methods of much importance have been developed, except in one case. I refer to the application of metallographic methods to the study of opaque minerals, which has recently been brought out by Mr. William Campbell, and which has already yielded such excellent results in the study of Canadian occurrences.

The geologist beginning his study of ore deposits is perhaps not at once deeply impressed with the necessity of chemical work. But this position is soon likely to change and he comes to recognize chemical work as absolutely essential. He then feels deeply his own insufficient knowledge of analytical chemistry and realizes that the experimental work to support his deductions must be done by a professional chemist. Unfortunately it is most difficult to find chemists who are also interested in geological studies and who have means or opportunity to pursue them.

As to the general method of study of ore deposits two ways are possible. We can either make a monographic study of a given deposit or group of deposits, considering them alone and tracing their origin and history by detailed observations. On the other hand, we can neglect in some degree the minor features of each deposit and instead study a great number of adjacent localities in their geographic and geologic relations. Two methods thus contrasted, the monographic and the geographic, have both been tried in the United States, but most weight

*Abstract of Presidential address delivered before the Geological Society of Washington, December 19, 1907.

has ever been laid on the monographic treatment. Undoubtedly the geographic treatment offers great possibilities, and it should be more emphasized in the future. At the present time in this country we are in the position of knowing a limited number of districts with great minuteness, but concerning the distribution of the metals and their connection with geological structure, the "metallogenetic provinces" of DeLaunay, our knowledge is insufficient. The most prominent advocate of this geographic treatment is at present Professor De Launay in Paris, and it is especially emphasized in two of his publications. The first is a study of the mineral wealth of Africa, published in 1903; the second, published at the last Geological Congress in Mexico, a similar monograph of the distribution of mineral deposits in Italy and adjacent parts of France, Switzerland, and Austria. In his own words DeLaunay "desires to show the distribution of the various regional types of mineral deposits, and the accord of these types with the geological structure, with the age of the rocks, and with the eruptive districts." Both books, and especially the latter, furnish much instructive reading, and the treatment could be followed with success in some of our publications. Mr. Spurr, in his Tonopah report, has also emphasized the necessity for geographic discussion of the distribution of deposits and speaks of "metallographic provinces."

There is another subject which is of great importance in our science. I refer to the study of the hot springs, which modern investigation has so clearly shown to be the carriers of metals and the cause of many ore deposits. We know what has been done in the past and how stimulating have been, for instance, the researches of Becker of the Steamboat Springs in Nevada and at the Sulphur Banks, of California, but the fact remains that very little has been accomplished in recent years to further advance this line of study. The study of hot springs, particularly in the Western States, should be undertaken not only from the monographic, but also from the geographic standpoint, and such treatment will be very likely to result in valuable generalizations. It is true that numerous analyses have been made of individual springs, and sometimes also of spring deposits, but to be of value such examinations must be carried on with special precautions and great detail. Many interesting facts have been developed. I refer, for instance, to the discovery of cinnabar and gold in spring deposits of New Zealand; to the discovery of tin in certain hot spring deposits in the Malay Peninsula; and to the studies of the Doughty Springs of Colorado by Headden, showing the deposition of barite and the presence of radio-active substances. Dr. Delkeskamp in recent numbers of the *Zeitschrift für praktische Geologie* has undertaken a study of mineral springs in Germany, but this work does not contain so much of new chemical research, but is rather based on old materials. An effort in this line has been made by Jaquot and Willm, who some ten years ago issued a monograph on the mineral springs of France, accompanied by most instructive maps and tables showing the relation of the waters to the geological structure. Unfortunately the work was not primarily undertaken from a geological standpoint. More recently DeLaunay issued a useful volume on hot springs, but the wide scope of the work in some degree impaired its value.

Attempts have been made, as you know, to perfect a genetic classification of ore deposits, but it must be confessed that we are still far from the goal, and many editors of text-books candidly throw consistent genetic classification to the winds and describe ore deposits geographically, or by metals, or by the old terms of bedded, massive, or tabular deposits. Two genetic terms have, however, found general acceptance after their recent introduction by Stelzner and Beck. The terms are *syngenetic* and *epigenetic*. The former comprise those deposits which originate simultaneously with the surrounding rocks either through the differentiation of magmas, through mechanical deposition, or through chemical precipitation in seas or lakes. In the epigenetic deposits, on the other hand, the ores formed by filling or metasomatic action are later than the encasing rocks. During the last years many deposits have, by prevailing opinion, shifted their position in relation to these two genetic distinctions. A comparison of the older text-books with those of today will show this convincingly.

In general the syngenetic class of igneous origin has grown considerably. As shown in recent papers by Löfstrand, Stutzer, and Sjögren the views as to the genesis of the enormous deposits of North Swedish apatitic iron ores have changed, and these ores are now with considerable confidence regarded as products of magmatic differentiation on a large scale, in part even as distinct eruptive dikes. It is only fair to say that among the older advocates of a sedimentary or igneo-sedimentary mode of origin, this view does not find acceptance. The syngenetic class has also gained by the interpretation of certain pyritic deposits, such as the Sudbury ores as products of differentiation of igneous rock magmas. Coleman and Barlow have, as you know, recently described these deposits, but here too we find their views challenged by a few geologists.

On the other hand, there exists today a very strong tendency to transfer many occurrences, formerly held to be of syngenetic-sedimentary origin to the epigenetic class. A few examples will bring this more vividly before us.

The copper and lead-bearing sandstones, shales, and conglomerates have long attracted attention, and the consensus of opinion was that the metals had been precipitated through chemical agencies from the sea-water. During the last few years, on the other hand, continued research has shown that they are much more probably epigenetic, that is, that the minerals in their present position have been concentrated in the beds after the sedimentation, and this view is held not only by those who believe that the metals came from below carried by ascending spring waters, but by observers who think it more probable that they represent concentrations effected by surface waters.

Still another example of a change in genetic classification is furnished by the pyritic deposits, for many

years favorite battle-ground for mining geologists. Some twenty years ago it was generally believed that these large masses of copper-bearing pyrite, generally encased in amphibolite or in clay slates, were of true sedimentary origin. We still find defenders of this theory, but their number is rapidly diminishing. Perhaps the most notable supporter of the syngenetic view is Professor Kloekmann in Germany. He holds, for instance, that the large orebodies of Rio Tinto in Spain have been caused by the accumulation of pyritic concretions in a plastic shale mud charged with the chemical constituents of the pyrite. The origin of the iron and sulphur is sought in submarine flows of volcanic rocks. In a somewhat similar way he would explain the Mansfield copper shales, the lead-bearing sandstones of Mechernich, and many other deposits.

Professor Bergeat of Clausthal maintains the same origin for pyritic masses. He is especially certain that the beds of Rammelsberg are formed by sedimentation, and, although not quite as pronounced in his opinion as Professor Klockmann, inclines to the belief that all of the pyritic deposits are of a similar nature.

On the other hand, the prevailing trend of modern thought is unquestionably away from these views. Beck advocates unhesitatingly an epigenetic origin through ascending solutions for the majority of these deposits. Gregory has lately in a careful description of the Mount Lyell mines in Tasmania strongly maintained an origin by ascending solutions. The recent literature in the *Zeitschrift für praktische Geologie* contains many articles on pyritic deposits, and in the majority of cases the epigenetic features are strongly insisted upon. You are no doubt aware that Professor Vogt, of Norway, holds similar and still more radical opinions, thinking, in fact, that most of the pyritic deposits are products of magmatic differentiation. Our knowledge of the contact metamorphic deposits is constantly widening. From being considered oddities or exceptions they have acquired their rightful and important position. The papers of Professor Kemp have largely contributed to this. In a recent paper Mr. Fukichi describes twenty-four such deposits from Japan.

Correct ideas on metamorphism will ever help us in achieving true explanation of ore deposits. The great work of Van Hise on metamorphism, published in 1904, and the work of Grubenmann, which appeared in 1904 and 1907, place for the first time the study of the metamorphic processes on a thoroughly scientific basis. Few ideas have been more fruitful than the conception of the several zones of the depths, each distinguished by its prevailing set of chemical reactions and by its own set of minerals. With proper limitations these conceptions can be applied most successfully to ore deposits, especially when we endeavor to ascertain the laws in accordance with which mineralogical character and depth of deposition are related. Wherever studies of the mineralogical and other essential characteristics of deposits can be made in connection with approximately accurate estimates of the thickness of cover eroded away since the ores were primarily deposited, such investigations will lead us far toward a true insight into mineral deposition. DeLaunay was perhaps the first to follow this line of reasoning in an important article published in 1900 on 'The Variation of Metalliferous Veins in Depth.'

Naturally, perhaps, we lay stress on the processes of first deposition, but it is well to remember that in the majority of cases our mines are working on ores resulting from the re-arrangement and often from the concentration of the originally deposited material. It is surely not necessary to recall the important advance in our knowledge of these processes made by the almost simultaneous announcement in 1900 by Emmons, DeLaunay, and Weed of the secondary sulphide concentration. In our literature on this subject there is perhaps some confusion of terms in the employment of the words 'primary' and 'secondary,' and it is always advisable to be precise in the use of these expressions. De Launay employs the term "*remise en mouvement*" for the general secondary changes in ore deposits, which perhaps could be best rendered in English by migration. This migration may be effected by new supplies of ascending waters, but more generally descending surface waters are the agents. Much attention is given to these migrations in recent literature; Krusch in the *Zeitschrift für praktische Geologie* of 1906 sums up the available data and seeks to establish criteria for minerals of primary and secondary deposition. It must be confessed the two are often difficult to distinguish, as in Butte, for example. Changes in the primary vein deposits in depth are known to exist, and the whole subject needs more study. At present secondary sulphide deposits of chalcocite, bornite, and rich silver ores are well proved. Much less general seem to be the secondary sulphides of lead, zinc, and iron. Gold being soluble with difficulty migrates very slowly, but will do so if given abundant geologic time.

In the preceding remarks I have confined myself to chemical and mineralogical features of ore deposits. It is unnecessary to say that this comprises only half of our work. The form and structure of the deposits should of course be recorded for theoretical as well as for practical considerations. With more or less success this is always attempted. As examples of recent good work in this direction I should like to call your attention to a remarkable book issued in 1903 by the Austrian Government on the metasomatic lead-zinc mines of Raibl; it contains about seventy excellent chromo-lithographs of particularly good exposures of the deposits as recorded by the Government engineers. The recent Victorian reports on Bendigo and Ballarat veins are also models in this respect. Still another is shown in Spurr's treatment of the faulting of Tonopah veins.

But after we are done with the description of our deposits and with the explanation, if attainable, of the manner of mineral formation, the question of its ultimate origin always remains, that most difficult and unsatisfactory chapter to write, since it is in part based on hypotheses and suppositions. Whence came these solutions, these carriers of the

rarer metals? Aqueous deposition is universally accepted for the epigenetic deposition. We are all familiar with the theory of circulating and depositing or surface waters whose ablest exponent is Van Hise, and which found almost universal approval in the last years of the nineteenth century. The metals contained in the re-ascending surface waters were held by Stelzner to come from "indefinite depths," by Posepny to be extracted from the "barysphere," by Sandberger from the wall rocks of the deposits, by Van Hise finally by gradual solution of minute traces in the rocks during the descent of the waters.

Toward the close of the nineteenth century the brilliant suggestions of Elie de Beaumont of metal-bearing solutions separated from cooling magmas, dormant through many years and counting only a few not very aggressive adherents in France, seemed to rise from the past and were espoused in a spirited manner by Professor Vogt. Shortly afterward, during the first years of this century, American observers began to give consideration to it. The geologists of the Cordilleran region took it up with enthusiasm, as it seemed to explain so many of the questions which confronted them in a field where later metamorphic action had not dimmed the picture of the intimate and undissoluble connection of the precious metal deposits with the igneous rocks.

And so, in the study of genesis, the most remarkable tendency during the last few years has consisted in this rapid and widespread, though not unanimous acceptance of the magmatic theory, according to which all igneous magmas contain water and dissolved metals which upon the ascent of the magma into a zone of lessening pressure are given off, penetrate the surrounding rocks, and ascend to the surface as thermal springs. The results would in consecutive order consist of: (1) product of igneous differentiation in the magmas, (2) contact deposits at the point where the volatile substances left the magma, (3) deposits by magmatic waters on their way to the surface at greater or less distance from their point of origin and more or less mixed with surface waters. The theory that many hot ascending waters and much of their dissolved substances are of magmatic origin has been supported by some of the ablest men in geology, notably by Professor Suess. In recent papers Dr. Delkeskamp has attempted to establish criteria for the separation of the magmatic, or plutonic waters as many call them, from those of surface origin. It is impossible to peruse the literature of any country of the last few years without noticing the remarkable spread of this idea. It seems to pervade the whole atmosphere of research in economic geology, and finds expression among the workers from all countries. Perhaps it is most clearly expressed in the recent text-books. I refer first to the third edition of Professor Kemp's book on the ore deposits of the United States and Canada. Further to the somewhat later volume on mineral deposits by Professor Beck of Freiberg (translated by W. H. Weed), whose attachment for this theory and for the epigenetic mode of origin of most ore deposits is well known. The just completed hand-book of Professor Bergeat, based on Stelzner's earlier work, advocates magmatic origin for contact metamorphic deposits and for a large group of veins, although, in regard to the plutonic origin of modern springs, it still occupies a noncommittal position. On the other hand, it is to be noted that this author strongly opposes this mode of origin as applied to pyritic deposits and many others of the so-called bedded deposits. Beck, although an ardent supporter of the igneous theory, finds himself unable to accept such an origin for the middle Swedish iron ores, and it should be noted that Vogt himself, in spite of his predilection for magmatic theories, believes that this class of deposits was formed by original sedimentation. As explained above, other men have recently re-opened the argument and hold that here also igneous processes have been active.

In his great volume on metamorphism, issued in 1904, Professor Van Hise gives large space to the origin of ore deposits and his views represent plainly the present standpoint of the believers in the efficacy of atmospheric waters as originators of the greater number of ore deposits. While he recognizes that magmas contain waters and metals and that they are given off under favorable conditions near the contacts, he denies the propriety of referring the hot springs in volcanic districts to a magmatic origin, and believes that circulating surface waters have dissolved and re-deposited the metals contained in minute traces in the igneous rocks. It should be noted that Professor DeLaunay occupies a somewhat similar position. As expressed in his recent book on mineral springs he follows Daubrée in believing that most hot waters are of superficial origin, even where they occur in connection with igneous rocks. While not denying that volatile elements, such as carbon dioxide, arsenic, sulphur, etc., are derived from the magmas, yet he holds that the water is probably of superficial origin. It is an odd relation that the teachings of Elie de Beaumont should find but a partial acceptance in his own country, while in a modified form they have spread all over the world.

Perhaps the adherents of the magmatic theory go too far in some cases, as always happens in a new swing of opinion toward fresh and attractive views, but I believe it is safe to say that this theory has come to stay and that this and no other satisfactorily explains many ore deposits. Far be it from me to deny the power of surface waters, especially when somewhat heated by long underground passages, to dissolve and deposit material, and their work of concentrating metallic values is surely most efficacious in porous sedimentary rocks. Furthermore, it must be remembered that the magmatic waters constantly mix with those from the surface and that, as pointed out by many observers, this is one of the most potent causes for precipitation.

The work of Dr. Lane on the waters in the deep mines of Michigan has changed our views of the deep-seated rock moisture in showing that it con-

sists chiefly of strong solutions of chlorides, and, with this in view, attention should be directed to the mineralizing and especially the dehydrating power of such solutions.

The prevailing theoretical tendencies of the present day may be summed up as follows: We unanimously agree in seeking the ultimate source of the metals in the igneous rocks. We say that the rarer metals and other substances in aqueous solution emanate from the magmas during and after their irruption into higher levels of the lithosphere, and that minerals containing these metals are deposited along the pathway of the waters. We assert that heated atmospheric waters may search the congealed rocks, abstract from them a part of the small residues of the valuable metals and deposit them along their channels. We say further that metamorphism, when acting upon these igneous rocks, is a potent factor in favor of further concentration, aided by the moisture contained in the rocks.

We say finally that as erosion degrades the volcanic mountains and their ore deposits, and the fragments are carried down to form sedimentary beds, the heavy native metals such as gold and platinum, are concentrated into placers, and the baser metals are distributed as salts of various kinds throughout the beds. Atmospheric waters take up these particles into solution, and, aided by the influence of sulphur compounds and organic matter, concentrate the deposits in congenial places. Ore deposits of value resulting from chemical precipitates in sea or lake water, form only in case of abundant metals like iron. It is possible that in this summing up is reflected too much of my own individual opinion, but I believe that it represents fairly the general trend of modern thought.

Volumetric Determination of Magnesium.—The volumetric determination of magnetism is founded on the fact that if one mixes the latter with an excess of potassium arsenate of known quantity the arsenic may be determined iodometrically in the filtrate. To carry out the determination the solution of the magnesia salt is mixed in a 100 c.c. calibrated flask and titrated with a known volume of arsenate solution in excess and with an addition of 10% ammonia filled up to the mark. The magnesium arsenate is filtered off after standing at least three hours, repeatedly decanted. Evaporate as large a part of the filtrate as possible to dryness; dissolve the residue in a little water and wash with colder 50% sulphuric acid or with fuming hydrochloric acid afterward. If the solution is now put into a corked vessel with potassium iodide solution and mixed thoroughly there usually appears a precipitate. Should the latter fail to appear, then add more acid, and dissolve the precipitate in the required quantity of water. The titration of the free iodine follows with the sulphate. Each cubic centimetre of $^1/_{10}$ N. This sulphate at the end point requires less than for the titration of the employed amount of the arsenate solution, and corresponds to 1218 milligrams of Mg or 2018 milligrams of MgO.—*Chemiker Zeitung*, December 18, 1907.

Decisions Relating to Mining.

Specially reported for the MINING AND SCIENTIFIC PRESS.

Evidence that an explosion of gases, which injured a miner, was aggravated by dust in the air, and which as a direct consequence of such aggravation became the proximate cause of the injury, was not unworthy of precedence as being unreasonable, as the weight to be given it was a question for the jury.

Davis *v.* Illinois Collieries Co., (Ill.) 83 Northeast. 836, Feb., 1908.

Where a coal miner fired a blast in an unskillful and unlawful manner, which caused an explosion of gas that was generated by a former shot, it was held not to preclude a recovery by him from the owner or operator of the mine for injuries caused by an aggravation of the explosion resulting from the air being charged with dust, if such explosion would not have injured him except for such aggravation.

Davis *v.* Illinois Collieries Co., (Ill.) 83 Northeast. 836, Feb., 1908.

A contract for the sale of certain mining claims provided for the payment of the agreed price in installments; the purchaser also agreed to perform certain development work, and the proceeds of any ore secured was to be equally divided between the parties; but if the purchase was consummated, any money paid to the seller was to be credited on the purchase price, and in case of a default in the payment of any installment the contract should be forfeited, and all sums paid should be treated as rent for the property. After the purchaser failed to pay an installment, the seller, after demand for payment, notified the purchaser that he elected to terminate the contract because of the purchaser's failure to perform the required development work. The seller obtained peaceable possession of the property and brought an action to quiet his title as against the contract. The court held that the seller's acts after the purchaser's default were consistent with an election to enforce the forfeiture; and that the purchaser was not entitled to recover the amounts paid by him under the contract, on the claim that there had been a mutual recission.

Ousler *v.* Thacher, (Cal.) 93 Pac. 1007, Jan., 1908.

A master is under no duty to warn or instruct a servant as to dangers discoverable by the exercise of ordinary care. And a servant engaged in blasting should know, or ought to have known, the danger in charging a hole with powder within a few minutes after springing the hole, and he was not entitled as of right to any warning on the part of the master, and that under such circumstances the master was not guilty of negligence in failing to instruct or warn the servant as to the danger incident to the work.

Hardy *v.* Chicago &c. R. Co., (Iowa) 115 Northwest. 8, Feb., 1908.

Equity will relieve from a technical forfeiture in the case of a mine lease where no pecuniary or substantial injury had resulted, and the performance by the lessee of all the covenants and duties imposed upon him by the lease, where the right of no third party had intervened.

Pheasant *v.* Hanna, (W. Va.) 60 Southeast. 618, Feb., 1908.

A written contract for the sale or option of coal in place must be duly acknowledged or proved by two witnesses under the statute of West Virginia, before it can be admitted to record by the clerk of the County Court of the proper county. And a contract of sale or option not so acknowledged or witnessed and improperly admitted to record and copied into the record book, was not a recorded contract, and was not notice to subsequent purchasers.

South Penn Coal Co. *v.* Smith, (W. Va.) 60 Southeast. 593, Feb., 1908.

THE CHURN-DRILL AS A MEANS FOR PROSPECTING.

Written for the MINING AND SCIENTIFIC PRESS
By E. E. CARTER.

The churn-drill has for many years been recognized as the cheapest and most economical means of finding oil and water, but it is only within the last few years that attention has been given to its application in mineral prospecting. This is largely due to the increase in the price of diamonds. Five years ago diamonds suitable for drilling purposes could be had for $18 per carat. They are now selling at $95, and the outlook is that the price may soon practically prohibit their use as a means for core-drilling. For this and for other reasons, inventive genius has been called upon to devise appliances whereby a core may be taken from the rock without the use of diamond. The inventor seems limited to two classes of machines, namely, to percussive drills, of which the churn-drill is a type, and to rotary drills, of which the diamond and chilled-shot drills are examples. The churn-drill is operated by means of a rope or cable, while the rotary drill must have hollow rods.

It has been proved by repeated experience that it is not practical to operate a percussion drill with hollow rods. This is due to the continual vibration, causing the rod to crystallize and break. Even should this difficulty be overcome, it is still evident that it is much more expedient and economical to reel in the tools by means of a rope than it is to draw and uncouple a great many rods. It has been found that it is not practicable to take a core more than 10 ft. long, and it is more satisfactory to see the core every three or four feet. Considering these reasons we find that the most satisfactory results are had with the churn-drill with its rope.

It is only recently that the core-barrel has been applied to the churn-drill. There are at the present time a number of simple and ingenious devices enabling the driller to get a satisfactory core that will furnish a valuable means for sampling and determining the value of a property. The churn-drill is manufactured in portable form, mounted on wheels, and so equipped with traction mechanism that it may be propelled by its own power over quite rough country. As to placer prospecting with these drills, it is unnecessary to say much. Anyone familiar with the placers around Oroville, California, knows what a valuable part these machines have played in proving the ground. It might, however, be mentioned that the drill is not only used to find the profitable gravel, but also to drill a series of blast-holes in front of the dredge for the purpose of loosening the ground for excavation.

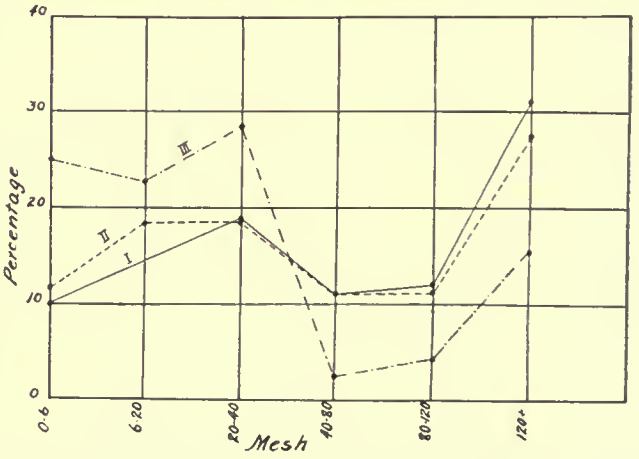
The value of a record of a drill-hole is in an inverse proportion to the value of the ore deposit. It must therefore appeal to us that its greatest efficiency is found in prospecting large low-grade deposits. Our attention is called to the methods used at Ely, Nevada, and at Bingham, Utah. At these places drills have been used to prospect the orebodies, and they are also being brought into service to drill blast-holes in their open-cut methods of mining, in which heavy blasts and steam-shovels are used. In the Missouri lead and zinc fields, as well as in the mines of the northern iron deposits, we find the prospecting largely done by means of the churn-drill. Very little advance has been made in opening up large low-grade gold mines along these lines.

In general we may sum up the churn-drilled borehole, as a means of prospecting, as follows: The value of the record is in inverse proportion to the grade of the ore; the assay is limited to the core and the cuttings; it is limited to all vertical work; it is necessary to put casing in all holes, but this may be withdrawn and re-used; the cost per foot is about one-third that of diamond drilling under the same conditions; the size of the hole is two or three times the size of the ordinary diamond-drill holes; the cost of the equipment, due to its simplicity, is comparatively small; it is possible to determine the dip, strike, and assay-value of the orebody and the country rock through which you will have to cut to reach the ore in running your main workings, thus making it possible to pre-determine the most suitable situation for your works, and to estimate the cost of reaching your orebodies.

As this method is becoming so favorably known and the results shown by some of the best mines in the country seem to confirm the opinion that this means of prospecting is proving effective, it seems probable that we may consider the churn-drill as a machine of more than ordinary importance for the future of the mining world.

Comparative Crushing Experiment by Rolls and Ball-Mill.—To determine the nature of the crushing by either of these machines the following experiments were made:

In experiment I of the figure, matte was crushed in a ball-mill to pass a 6-mm. screen; in II this mill crushed ordinary roasting sulphide. Note the close execution of the work in both cases. In III a sul-

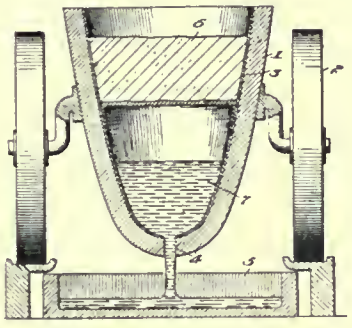


phide ore containing gypsum and pyrite was crushed by rolls to pass a slotted screen $^{3}/_{16}$ by $^{3}/_{4}$ in. From the graphic curves of the figure we note that a greater portion was coarse-crushed. In the case of both ball-mill and rolls we note a maximum at the size 20 to 40, and of that finer than 120-mesh, but it can be seen that the rolls make less fine than the ball-mill. A minimum amount of material is to be found between 40 and 120 mesh.

MINING AND METALLURGICAL PATENTS.

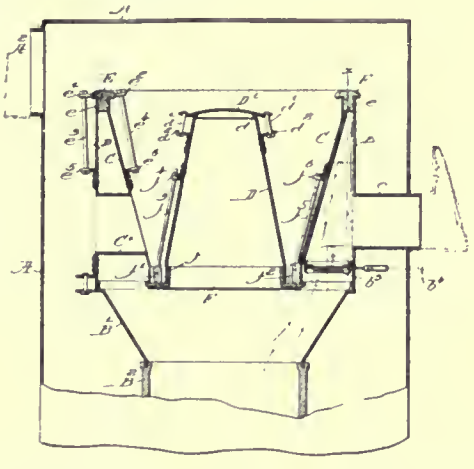
Specially Reported for the MINING AND SCIENTIFIC PRESS.

PROCESS OF PRODUCING SLAG-FREE FERROCHROMIUM.—No. 882,637. John B. Huffard, Ferris, West Virginia.



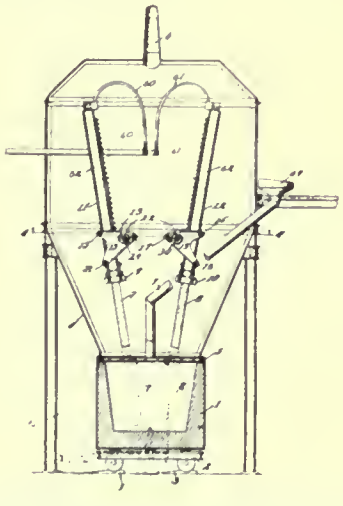
The process of producing metals free from slags of relatively high melting points, which consists in discharging the molten metal and slag into a vessel, allowing the metal and slag to stratify and the slag to solidify, and separating the molten metal from the solid slag.

FURNACE.—No. 882,616. Henry Bluhm and Joseph H. Regan, Boston, Massachusetts.



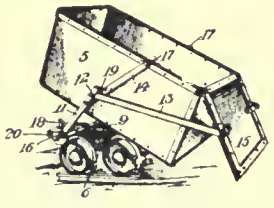
In a furnace, a heating surface comprising outer and inner walls, a central dome having a cap, a ring sustaining the lower end of said dome and fitting the lower end of said inner wall, said inner wall, ring, and dome each having ears, and tie rods to connect said ring respectively with the ears of the dome and inner wall.

ELECTRIC FURNACE.—No. 883,110. Herman L. Hartenstein, Constantine, Michigan.



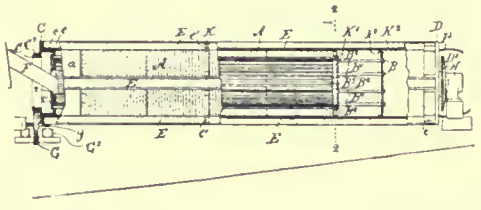
In an electric furnace, the combination of an inclosure constituting a furnace chamber, movable electrodes situated within said chamber, conductors leading into said chamber, and yielding connections between the electrodes and said conductors.

DOOR-OPERATING MECHANISM FOR ORE-CARS.—No. 884,091. George C. Johnson, Los Angeles, California.



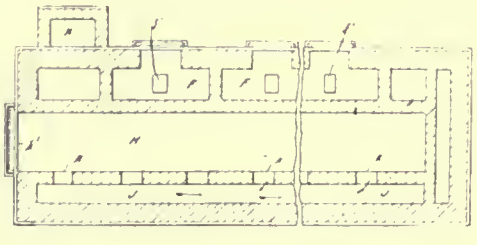
A composite lever for operating swing doors at the end of the body of ore cars or the like, comprising three members, these members being pivotally secured to each other at one of their ends, the other ends of these members being pivoted as follows, one to the body of the truck, one to the body of the car, and the other to the swinging door.

GOLD-WASHING SCREEN.—No. 883,974. William H. Roughsedge, Ottawa, Ontario, Canada.



In a screen, the combination with a head ring and a tail ring each having seats for longitudinal beams, longitudinal beams having their ends secured in said seats and connecting the said rings, a shoulder on said head ring to receive the end of the outer screening cylinder, a disc flange on said head ring to receive the ends of longitudinal screen bars forming the inner screening cylinder, a tread ring secured to said head ring, carrying rolls upon which the tread ring is supported, journal supports of said rolls, a bevel wheel on said tail ring with trunnion, a journal bearing for said trunnion suitably supported, a cross shaft suitably journaled, means for giving motion to said shaft, a bevel pinion on said gear, gearing into said bevel wheel, a plate ring secured to the longitudinal beams some distance from the tail ring and having secured in it the ends of some of the longitudinal screen bars forming the inner screen, a pair of tire-rings placed some distance from said plate ring and between which the ends of the shorter longitudinal screen bars are placed, an outer tire-ring in the same plane as the other two tire rings secured to the longitudinal beams and supporting the outer screening cylinder and stay bolts passing from the said outer ring to the inner ring, substantially as set forth.

FURNACE.—No. 883,916. Alfred Smallwood, London, England.



A smelting, crucible heating, and annealing furnace, comprising a fire grate, a horizontal combustion chamber in communication therewith, a heat chamber situated above the combustion chamber and communicating with the latter at the end remote from the fire grate, an annealing chamber situated adjacent the heat chamber and having a plurality of apertures through one of its walls, and means for selectively opening and closing the apertures of the annealing chamber.

MINE REPORTS.

BROKEN HILL PROPRIETARY, NEW SOUTH WALES.

The forty-fifth half-yearly ordinary general meeting of the Broken Hill Proprietary Co., Ltd., was held in Melbourne, February 28, 1908.

The chairman, Mr. John Darling, stated that last August everything connected with the company was in a most prosperous condition, and although then there were indications of prices being at their maximum, and that some decline might reasonably be looked for, no one anticipated that the markets for silver and lead would so seriously break. There are many circumstances responsible for the altered position. Primarily, no doubt the financial crisis in America, so strongly reflected in Europe, was a great factor, as it caused a contraction in trade and commerce, which at all times is quickly felt in such commodities as lead and silver. Although abnormal prices may not be again seen for many years, yet a steady market at about £14 per ton for lead, and 2s. 2d. per oz. for silver may be reasonably looked for. The silver market was largely affected by absence of rain in India, thereby restricting the demand in that country, and in consequence dealers in India and China took advantage of the position by selling forward, and no immediate relief was obtainable, as stocks on hand were large, with no demand.

The highest point reached for lead in 1907 was £22, and a sharp decline to £13 was recorded at the close of that year, being 40% from the maximum reached. Zinc, also, in sympathy, declined from £28 to £20 10s., or a fall of 27%. Under such circumstances it is not to be expected that, by comparison with the two preceding half-years, a satisfactory report can be shown, particularly as no compensating reductions in the costs of mining and treatment have occurred. The increased wages are still in force, and will not be disturbed until the period agreed upon has expired, when, if no improvement takes place, it will then be absolutely necessary to look for some relief in the lowering of present costs.

During the period under review the mine has not suffered from the effects of the fire, as the precautions taken by the provision and attention to water curtains have prevented any interference with the work of the mine. It has, however, necessitated a further expenditure of £3173, against £4498 the previous half-year, or a total expenditure to date of about £36,000.

The ore reserves have not been materially increased by new discoveries or developments. On May 31 last there were 2,955,000 tons, since which 312,158 tons of ore have been raised, leaving at date 2,643,000 tons, and this quantity gives two years' full output of 10,000 to 12,000 tons per week. Similar remarks were made in 1904, since which time new discoveries have been made, and it is quite probable that in this regard history will repeat itself. The quantity of ore raised for the period was 312,158 tons, being about 22,000 tons more than in the previous half-year, the average cost of mining, inclusive of development work, etc., being 15s. 8.41d. per ton, or about 1s. 1d. per ton more than the preceding period, about 9d. per ton of which is due to increased development and to diamond drilling, and the balance to slightly increased earnings of contractors, greater quantity of timber used, together with increased expenditure in water and sundry small items. With the prosperity that was enjoyed, the opportunity to push on with development and exploration was largely availed of, with an expenditure of £40,000, being the largest on record. The boring that was started at the 400 and 500-ft. levels from Block 14 main shaft, with the purpose of picking up the eastern lode revealed by the British mine workings in the vicinity of this company's Block No. 80, has now been stopped, nothing having been met with, and the same also applies to the boring from the 650-ft. level opposite Stewart's shaft, which was started with the same object. Besides this work, one small and two large diamond drills have been almost constantly at work, proving the ground in various places, boring in all 3056 feet.

At the 1200-ft. level the south drift was extended 140 ft. and the north drift 150 ft. (the last 110 ft. in country rock), disclosing a total length of ore of 1020 ft. on this level north of Block 10 boundary. The appearances at the 1200-ft. level are more satisfactory as the orebody, before pitching to the south, extended 400 ft. farther north than was expected from the indications at the upper levels. Shaft sinking has been carried on vigorously. The blind shaft in Block 11 having been sunk 145 ft., the total depth now being 1345 ft. Stewart shaft has been deepened to 1212 ft. Delprat's shaft is down 1302 feet.

The ore dressing mill has treated 298,327 tons of crude ore of a slightly lower grade than the previous half-year, and the recovery in lead in concentrate slime is about 50% higher, but about 33% lower in concentrate only, at an increased cost of about 5d. per ton, of which 3d. per ton was due to the additional cost of water. The re-grinding plant has now been erected and is treating about 300 tons of coarse tailing per day. The sulphuric acid plant has been enlarged, producing 2295 tons of strong acid as against 1133 tons the previous half-year, and has resulted in lowering the cost about 7s. 6d. per ton. The zinc plant has been worked to its fullest capacity, and has treated 175,021 tons, yielding 41,203 tons of concentrate. The concentrate averaged 42.36% zinc, being the highest average for a like period from this plant. The increased cost of 10d. per ton of tailing was due principally to the cost of re-grinding a portion of the feed, which is more than compensated for by the lead concentrate recovered by the tables.

Additions have been made to the electric power plant, air-compressors, pumping station, and new workshops, a water-softening plant, condensing plant (to meet emergency of drought), and an exhaust steam turbine and accumulator have been provided.

At Port Pirie the smelting plant has continued to do good work, and with the introduction of the 'Turbo' blower satisfactory results have been obtained, so much so that it promises to revolutionize the company's smelting operations, and will more than repay the cost in a short time. With some alterations in the furnaces, by increasing the length of the water jackets and the depth of the crucibles, it is expected that as much work can be done in four furnaces as was done by seven previously. Improvements have been made in the Huntington-Heberlein process by a new method of treating the material in the converters by cooling and then wetting until it contains 10% water, the result being that less lead is volatilized. The temporary machine, capable of treating 300 tons per day, was at first experimental, but has now proved so great a success that a permanent one is being prepared. Five new converters have been provided, making a total of 22. The total quantity of ore and slime treated at the smelting works for the half-year was 109,342 tons, together with drosses and flue dust 4656 tons, giving a production of 29,612 tons of lead, 1,976,078 oz. silver, and 1295 oz. gold, requiring as flux iron, limestone, coke, etc., 121,705 tons. At the zinc plant Mr. Arnemann is now actively engaged in erecting an up-to-date retort furnace, together with the necessary drying-rooms for retorts, and he expects to have the furnace finished ready for drying by March, and to produce by the end of June.

The scheme for an improved water supply for Broken Hill still occupies serious attention. The Umberumberka Amending Act on the lines indicated by the mining companies has been passed by the New South Wales parliament. The services of a hydraulic engineer have been secured, and after much investigation a site has been recommended for a suitable dam.

The net profit for the half-year is £137,642 0s. 5d., as against £308,238 8s. 2d. for the preceding half-year. The profit per ton of ore treated has been 8s. 9d. per ton, as against £1 0s. 9d. The liquid assets are £497,471 9s. 6d., inclusive of reserve and insurance funds, the two former standing at £225,000, and the latter at £35,000. Two dividends and bonuses to the extent of £288,000 have been paid during the half-year. The sales of lead have been 29,742 tons, of which 20,961 tons were to Europe, 5467 to India, China, and Japan, and 3314 tons in Australasia.

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Editorial.

ON THE COUNCIL of the new Mining and Metallurgical Society of Ameriea are the following: H. S. Munroe, W. R. Ingalls, and J. R. Finlay, of New York; Robert H. Richards, of Boston; F. Lynwood Garrison and W. A. Lathrop, of Philadelphia; C. B. Dudley, of Altoona; Waldemar Lindgren, of Washington; L. S. Austin, of Houghton; G. S. Rice, of Chicago; Joseph Hyde Pratt, of Chapel Hill; C. R. Claghorn, of Tacoma; H. B. Patton, of Golden; S. B. Christy and T. A. Rickard, of San Francisco.

WE HAVE RECEIVED many letters recording the damage done to the business of legitimate mine promotion by the Yukon Gold flotation and Lawson's campaign of advertisement. It is stated that several important issues were killed by the timidity aroused by this unexpected association of so important a house as that of the Guggenheims with so notorious a *chevalier d'industrie*. Even unprejudiced observers were sorry to see recognized leaders in mining enterprise forming a partnership, indirect it may be, and implied rather than expressed, with a man who prostitutes the press to his stock-peddling campaigns. We yet hope to see a disavowal from Mr. Daniel Guggenheim and a confirmation of the gossip that the block of Yukon stock was optioned to another party, who was really blameworthy for enlisting the services of the champion bunco-steerer of America.

GOLD PRODUCTION on the Rand continues to advance, the output for the first quarter of the year being worth £7,124,117, or at the rate of $142,250,000 per annum. There are 8800 stamps dropping, as compared to 8540 a year ago and 6485 in 1905. Besides the increase in the number of stamps, there is an enlargement of production due to the use of heavier stamps and the supplementary grinding in tube-mills. Fully 75 of these useful machines are now employed. Another important factor in stimulating production has been the better supply of native labor; at the end of March there were 137,075 Kaffirs employed, as compared to 90,841 this time last year. This increment has done much to allay the anxiety caused by the repatriation of the Chinese coolies. Working costs are diminishing a little faster than the decrease in yield, so that profits are better in the cases of several mines. On the whole, affairs on the Rand wear a more cheerful look.

COMPANY PROMOTION is an integral part of the legitimate business of mining, and it is well that the fundamentals of this flotation process should be understood. Like the 'flotation' processes at Broken Hill, concerning which we have had some-

thing to say in a technical way, it is true of company promotion that it requires oil for smoothness and gas for stimulation. Joking apart, financial practices are as important, even to technical men, as metallurgical methods, and if they fail sometimes in making money honorably from applying their inventions it is due often to the misunderstanding of the proper steps to be followed in the devious ways of Throgmorton Avenue or Wall Street. Therefore the article by Mr. Henry A. Butters will prove useful and interesting. He writes as a man of authority, and not as a scribe, for he has initiated and organized important enterprises from New York to London, from Mexico to Geneva. A man that can make money by promotion and retain an honorable name must possess character and we listen to him with respect. Our readers will find that Mr. Butters covers the ground in a comprehensive way.

SILVER CYANIDE, as pointed out in the able scientific examination by Mr. W. A. Caldecott of the practice of cyaniding silver ores in Mexico, which appears in this issue, cannot co-exist in solution with more than a trace of sodium sulphide. As the solution of silver sulphide by sodium cyanide involves the formation of sodium sulphide, the disappointing results in leaching many silver ores are readily explained. No less interesting and important are the secondary reactions which, as Mr. Caldecott shows from careful experiments, may facilitate the solution of silver sulphide from its ores. Strikingly significant is the cycle of reactions to which Mr. Caldecott directs attention, occurring when lead is present. Introduced as oxide a reaction will take place with the sodium sulphide, producing sodium oxide and lead sulphide, which latter will at once react with sodium cyanide and free oxygen, forming the sulphocyanide with regeneration of the lead oxide. A small quantity of lead oxide will, by virtue of these cyclical reactions, protect the silver cyanide derived from the so-called free silver in the ore from being precipitated by the sodium sulphide which forms as the silver sulphide passes into solution. By throwing light on these reactions the article not only points the way to control of conditions for securing better economic results in a branch of cyanide treatment that has always been full of difficulty and discouragement, but it will suggest a promising line for further investigation by progressive metallurgical chemists.

The New Society.

IN this issue we publish the full text of the constitution and by-laws of the Mining and Metallurgical Society of America, as adopted at the organization meeting in New York on April 20. We are informed by telegraph that no changes of any importance were made at that time in the text of the constitution and by-laws, so that our readers can infer for themselves under what sailing orders the new professional ship is to go forth. We learn that the organization committee of the new Society held a conference with the council of the American Institute of Mining Engineers in the hope of effecting an affiliation, but nothing was done in this direction. Dr. Raymond, however, went so far as to say that the Institute would be willing to publish the papers of the new society at cost. Nor was it to be expected that a consolidation would be made; in fact, such a result would have prompted a strong doubt as to the necessity for a new organization. If the Mining & Metallurgical Society is to prove of service, it will be not by working on the same lines as the Institute, nor even on a parallel line, but by developing territory as yet not exploited. Most of the organizers of the new Society are members of the Institute. While it may be that there are members of the Institute who are inclined to criticize its administration, it is certain that the mainspring of the new departure is furnished by the desire to give the profession effective representation in a field of intellectual activity now entirely neglected by the Institute; in a word, the new Society will get scant support as a mere rival of the Institute, and half-hearted support if, even without intention, it should embarrass the Institute. What most of us, certainly those on this side of the continent, desire is to have a society that will crystallize professional practice, afford an opportunity for discussing ethical problems, enable the profession to give expression to its opinion on national questions, such as the mining law, legislation against fraud, prevention of accidents, and so forth; we want a society that can speak for the profession on such subjects as a proposed Mining Bureau, the work of the Geological Survey, the conservation of natural resources, and the many matters that affect the civic side of engineering life. All these subjects are tabooed by the Institute; under the dominating personality of its great Secretary the Institute has become a splendid publishing business and very little else. Let that work proceed without any attempt to duplicate it; certainly with no hope to better it. If the publishing of technical papers on the one hand and the ventilation of national, professional, and ethical questions on the other hand, are not kept separate by the two societies, we shall see a regrettable quarrel and an inevitable all-round failure.

We note that the constitution indicates the desire to 'stake out' a large claim, so as to cover the dips, spurs, and angles, besides any cross-veins of extra-lateral origin that may be discovered by deeper exploration. We take this as a desire to state comprehensive boundaries, so that any normal activity will not necessitate a re-statement of the position. Five principal objects are mentioned: the conservation of natural resources, the advancement of mining and metallurgical industries, the better protection of mine investors and mine workers, the increase of scientific knowledge, and the encouragement of high professional ideals. All of these are good and worthy purposes, but the fourth is one that can be shelved, and it must be set aside if it means camping on the trail of the Institute. There are many agencies for increasing scientific knowledge; the Institute is one of them; but there is no organization devoted

to the encouragement of high professional ideals, the better protection of mine investors and mine workers, and the like of that. Gentlemen, stick to your side-lines and let the Institute work the lode that it located, patented, and developed thirty years ago.

Mining and Gambling.

PEOPLE who gamble love to call themselves investors, but they rarely take the trouble to ascertain the result of their venture in advance, the fact being that long before their speculation will have run its course they intend to sell to someone else less well-informed or more adventurous. Thus in the case of the notorious Yukon Gold advertisement of the Guggenheim-Thompson-Lawson combination, the profits are stated at $38,000,000, to be won in 15 years. That looks like lots of money. But the company is capitalized at 3,500,000 shares of $5 each, or $17,500,000. Stock was offered at $7.50; on this basis the capitalization is $26,250,000. Allowing for a return of 38 millions in 15 years, with a 5% sinking fund re-invested at 4%, the net yield is only 4.65%, plus the principal. If we take Lawson's advice that the stock be purchased at $15 per share, or $52,500,000 for the whole, then the investor, who receives 38 millions in 15 years, will lose $17,500,000, which happens to coincide exactly with the nominal capital of the company; for if the $52,500,000 be invested today at 5%, with re-investment of dividends at 4%, at the end of 15 years the return would be just $17,500,000 ahead of the purchase of Yukon Gold at $15 per share. If all the income be used as a sinking fund for the redemption of the principal, then the final return would be $14.46, out of the $15 paid for the stock; and this makes no allowance for interest. If it be assumed that the property will return 38 millions in 15 years, and in the meanwhile yield 10% net to the investor, then each share of the 3,500,000 is worth $4.82, allowing for a sinking fund and re-investment as before. But the $38,000,000 is an estimate that includes "probabilities and possibilities" of an indefinite kind, and the analysis of the reports shows that, on an investment basis, there is an assurance of 19 million dollars being won in 9 years; on this basis the shares are worth $2.90 only, if a 10% yield be predicated, plus sinking fund as before.

Surely this is not without its suggestiveness. It does not point to mining as a poor investment, it merely emphasizes the fact that only clergymen and school teachers ever regard dealings in shares as other than highly speculative ventures. Because they are speculative they are not objectionable. Quite the contrary. Big risks bring big gains, but it is folly worn threadbare to buy stocks without accurate knowledge, on the expectation of selling to others during a boom, whether particular or general, and then to call such a financial adventure an investment. Don't play the fool and expect miracles to happen.

Another moral to be drawn from the episode is that capitalists, under the advice of experienced engineers, will speculate successfully in mines, but, not content with the slow return obtainable by actual exploitation, they turn around and, with the aid of promoters, whose only aim is to sell, they dispose of their holdings at a profit wholly unjustifiable, save on the score that to them that have shall be given, or on the basis that the inexperienced in finance must contribute to the knowing ones. This unloading on the public is the curse of mining, because, apart from the injury done to innocent people, it subordinates the technical features to the financial, in fact, to the predatory. By this trick of passing worthless mines onto the unsuspecting dabbler in stocks or of disposing valuable mines to the public at twice their real worth—so that in the end the result is much the same whether the mine be valuable or worthless—the actual operations at the mine or the metallurgical treatment of the product are belittled, the stockbroker becomes vastly more important than the engineer, Lawson is more effective than Perry. The profession suffers by being used for nefarious ends; the publicity obtainable through the press is prostituted to lying; mining is made a derision and a snare.

Bureau of Mines.

THE BILL for a Bureau of Mines was reported favorably, on April 16, back to the House of Representatives, with the endorsement of the Committee on Mines and Mining. It is uncertain what the next move may be, but the prospects are good for favorable legislative action. Care has been taken to avoid duplicating any duty that the Geological Survey is already authorized to perform. The committee says that the mere statement that "the mining industry adds annually to the wealth of the country a value of nearly two billions of dollars, and that this enormously valuable resource, second in value only to agriculture, receives substantially no promotion, no help, and no attention from the United States Government, ought to be argument enough for this bill." But beyond this consideration is the call for such Federal assistance to local authority as will lessen the appalling loss of life incident to labor in mines, especially in coal mines. The Bill asks for the establishment in the Department of the Interior, of a Bureau of Mines, to be directed by a Commissioner, to be appointed by the President, with a salary of $6000 per annum. The duty of this Bureau and its Commissioner shall be "to foster, promote, and develop the mining industries of the United States; to make diligent investigation of the methods of mining, the safety of miners, the possible improvement of conditions under which mining operations are carried on, the treatment of ores, the use of explosives and electricity, the prevention of accidents, the values of mineral products and markets for the same, and of other matters pertinent to said industries, and from time to time to make such public reports of the work, investigations, and information obtained as the Secretary of said Department may direct, with the recommendations of such Bureau."

Personal.

GELASIO CAETANI is at Monaco.

D'ARCY WEATHERBE is in Spain.

H. DEC. RICHARDS is at New York.

KARL EILERS is here from New York.

CURTIS H. LINDLEY is at Ely, Nevada.

W. J. LORING is at Denver, on his return to London.

LESLIE SIMPSON is on his way back to the Transvaal.

OSCAR H. HERSHEY is examining mines in eastern Oregon.

G. McM. Ross was in San Francisco several days this week.

HARMER C. SANDIFER is operating at Seven Troughs, Nevada.

W. H. WILEY is engaged as expert in mining litigation at Goldfield.

ALBERT ROBERTS has gone to Keen Camp, near Hemet, California.

ALBERT BURCH is examining mines in Siskiyou county, California.

W. M. KNOX has been drilling dredging ground near Folsom, California.

THEO. F. VAN WAGENEN is at Zacatecas, but will return to Denver shortly.

OTTO SUSSMAN now has an office at 420 Empire Bdg., Denver, as well as at New York.

E. H. MESSITER is visiting Oroville, on his return from Cananea and British Columbia.

V. P. STRANGE has returned to Salt Lake, after having visited Rawhide, Nev., and San Francisco.

J. JEROME SMITH has returned to Stockton from a visit to the Mother Lode, near Sonora, California.

CHARLES R. VAN HISE delivered the class-day address before the Michigan College of Mines on May 1.

LLEWELLYN HUMPHREYS has returned to Salt Lake from Nevada mining points, accompanied by L. EWING.

C. A. HEBERLEIN has resigned from the Compañia Metalnrgica de Torreón, and has gone to Zacatecas, Mexico.

JOHN DERN, president of the Consolidated Mercur Gold Mines Co., has left Salt Lake City on a four months European trip.

G. W. METCALFE, formerly with the United States smelter at Bingham Junction, Utah, has become superintendent of the Yampa smelter in Bingham canyon.

C. H. MUNRO, lately engaged professionally in Barranquilla, Colombia, has returned to San Francisco and will make his headquarters in the Crocker Building.

WALTER G. PERKINS, construction engineer and metallurgist for the Nevada Consolidated Copper Co. was at Salt Lake City recently, on his way to Butte.

M. A. NEWMAN, assistant general manager of the Minas del Tajo, is here. He will assnme charge of the Jesus Maria y Anexas and the La Piramida mines at San Jose de Gracia, in Sinaloa, Mexico.

JOHN P. COSGRO, mechanical superintendent American Smelters Securities Co., is seriously ill at St. Luke's Hospital, St. Louis, Missouri, with typhoid fever, contracted during a recent professional trip.

H. A. BUEHLAR has been elected Director of the Missouri Bureau of Geology, succeeding ERNEST R. BUCKLEY, who resigned. Mr. Buehlar is a graduate of the University of Wisconsin. He was at one time Assistant State Geologist of Missouri.

The Utah Society of Engineers, which has about 100 members, held its annual banquet in the Commercial Club rooms at Salt Lake City on April 21. The officers elected for the ensuing year were as follows: J. F. MERRILL, president; R. KLETTING, first vice-president; M. D. GROSH, second vice-president; D. MCNICHOL, secretary; HOWARD P. SAUNDERS, treasurer.

Latest Market Reports.

LOCAL METAL PRICES—Apr. 30.

Antimony	12@16c	Quicksliver (flask)	$45@45.50
Casting Copper	14¼@15¼c	Spelter	6½@ 7¼c
Pig Lead	4.45@ 5.40c	Tin	32¼@34c

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date	Electrolytic Copper	Lead	Spelter	Silver
Apr. 24	12.69	4.01	4.68	54
" 25	12.69	4.01	4.68	53½
" 26	Sunday.	No market.		
" 27	12.69	4.01	4.68	53⅜
" 28	12.69	4.03	4.68	53⅜
" 29	12.69	4.08	4.68	53½
" 30	12.69	4.08	4.68	52¾

ANGLO-AMERICAN SHARES.

Cabled from London.

	Apr. 23. £. s. d.	Apr. 30. £. s. d.	
Camp Bird	0 14 0	0 14 0	
El Oro	1 4 3	1 5 0	
Esperanza	1 7 6	1 2 6	ex div.
Dolores	1 5 0	1 6 3	
Oroville Dredging	0 12 3	0 11 10½	
Stratton's Independence	0 3 0	0 2 9	
Tomboy	1 11 3	1 12 6	

(By courtesy of W. P. Bonbright & Co., 24 Broad St., New York.)

MINING STOCK QUOTATIONS—NEW YORK.

	Closing prices. Apr. 23.	Apr. 30.
Bingham Central	¼	¼
Boston Copper	11½	11⅝
Cumberland Ely	7⅞	8
El Rayo	1¾	1¾
Giroux Con.	3½	3½
Guanajuato Con	2	2
Nevada Con	11⅛	11¾
Nipissing	6⅞	7
Tennessee Copper	37¼	36
United Copper	6¼	6¾
Utah Copper	29⅝	29½

(By courtesy of Hayden, Stone & Co., 25 Broad St., New York.)

SOUTHERN NEVADA STOCKS.

San Francisco, Apr. 30.

Atlanta	$ 25	Manhattan Con	13
Belmont	1.15	Midway	54
Columbia Mtn	20	Mizpah Extension	4
Combination Fraction	65	Mohawk	.....
Daisy	1.25	Montana Tonopah	1.75
Fairview Eagle	35	Nevada Hills	2 40
Florence	3.90	Rawhide Queen	1.75
Gold Bar (Bullfrog)	16	Red Top	.....
Goldfield Con	5.35	Sandstorm	34
Gold Kewanas	18	Silver Pick	21
Great Bend	41	St. Ives	33
Jim Butler	31	Tonopah Extension	1.05
Jumbo	.....	Tonopah of Nevada	7.50
Jumbo Extension	30	Tramp Con	20
Laguna	.....	West End	42

(By courtesy of W. C. Ralston, 353 Bush St.)

COPPER SHARES—BOSTON.

	Closing prices. Apr. 30.		Closing prices. Apr. 30.
Adventure	1⅝	Michigan	10½
Ahmeek	65	Mohawk	47½
Allouez	25¼	Nevada Con	11¼
Amalgamated	59⅞	North Butte	57
Arcadian	3½	Old Dominion	34¼
Atlantic	9⅜	Osceola	81
Bingham Con	.....	Parrot	19¼
Boston Con	11½	Phœnix	50
Butte Coalition	22	Quincy	81½
Calumet & Arizona	102	Rhode Island	3
Calumet & Hecla	637	Santa Fe	1⅝
Centennial	21	Shannon	11¾
Con. Mercur	40	Superior & Pittsburg	13¼
Copper Range	67	Tamarack	58
Daly-West	8⅝	Trinity	.....
Franklin	7½	United Copper com	6⅝
Granby	90	Utah Copper	29
Greene-Cananea, ctf	8	Victoria	2⅞
Isle Royale	19	Winona	4⅞
Mass	2¾	Wolverine	125

General Mining News.

ARIZONA.

GILA COUNTY.

Ore rich in gold and silver has been found at a depth of 10 ft. on the Clark lease of the Cole & Goodwin group of claims.

GRAHAM COUNTY.

The Gold Belt Co. has temporarily suspended, pending arrangements for construction of a small stamp-mill. The mill has not yet been purchased.

YAVAPAI COUNTY.

The 20-stamp mill at the Sultan will be moved to the Big Stick group, 20 miles northwest of Date creek.——It is reported that the largest orebody in the Octave mine is now being opened at the 1200-ft. level. The Cleopatra mine and smelter will start this week.——Work on the wagon-road for the Arizona Power Co., from Sycamore creek to the proposed power-plant on Fossil creek, is progressing rapidly, 200 men being employed.

CALIFORNIA.

BUTTE COUNTY.

The Blue Lead Mining Co. has been incorporated for the purpose of working the Blue Lead channel at Bangor. The company is now driving an adit from Honcut creek, so that when the Blue Lead channel is struck it may be properly drained.

EL DORADO COUNTY.

The owners of the Gilbert mine have already purchased a 10-stamp mill, which will be erected and put in operation at once.——Preparations are being made for the immediate equipment and operation of the Gold Hill mine, recently purchased by T. H. and Norval Douglas of Sacramento.——Good reports continue of the pay-shoot at the Fowler claim near Fort Hill. It is quartz ore and reported to be rich in gold.——Howard Misner has leased the Podoni mine in the Garden Valley district and will develop the property.——Green Bros. are erecting a complete 10-stamp mill on their property near Greenwood, where they have a body of good ore.

NEVADA COUNTY.

(Special Correspondence).—The Jenny Lind Co. has secured 30 additional acres of adjoining land by location and purchase. The new raise is expected to strike the channel in a few days.——The Golden Gate mine has been unwatered and driving east and west on the vein at the 400 level has started. The mill is running on ore from the upper workings. W. P. Martin is superintendent.——Development work will soon commence on the LeDuc claims on the eastern slope of Prescott hill. An adit will be driven and several men put to work. B. A. Penhall is superintendent. Some good ore has been struck in the Bear River Tunnel Con. mine. The vein is wide and of fair grade. Development work is going on steadily at the Spring Hill mine. A small force is working. The shaft at the Normandie is going down steadily. It is expected that ore will soon be encountered. High-grade ore is being extracted from several points in the Empire. About 300 men are employed.——The Brunswick mill is running steadily on good ore from the upper levels. A winze has disclosed good ore below the 300-ft. point.——The working force at the Union Hill mine has been increased. Two good veins are being developed.——The final payment has been made on the Mountain View mine in the Washington district and the property is now owned by the Miller M. Co. The Mountain View is producing steadily with good results. The new owners will work it on a more extensive scale.——The perpendicular double-compartment shaft at the Union Hill mine will be sunk to a depth of 1000 ft. early in June.——Sinking is progressing steadily at the Murchie mine. No further trouble has been experienced with the miners.——A large force is working at the Mountaineer and developing good ore. The main vein continues to show well.——Good ore has been developed in the Delhi. The working force will be increased soon.———Several Eastern mining men have been investigating mining properties in the Nevada City district during the past week.

Grass Valley, April 27.

The Champion and Delhi mines have been bonded to an English syndicate. The details of the transaction are not yet published, but it is believed that extensive improvements will be undertaken at both properties.——Development work is being resumed on the recent discovery of low-grade gold-lead ore near the Mason ranch, 14 miles from Grass Valley.——The ore-shoot has been reached in the Keller mine, a northern extension of the National and Culbertson at Graniteville.——It is reported that ore assaying about $15 per ton has been discovered on W. J. Mitchell's ranch, seven miles southwest of Grass Valley on the McCourtney road, near the junction of the Indian Springs road.

PLUMAS COUNTY.

The directors of the Newton Mining Co. have decided to continue mining operations on their property on Coquette

Slate Quarry, Placerville, California.

creek, near Buck's ranch. The work will be done by steam scrapers, and is only preparatory to operations on a large scale which the company expects to undertake next year.——The Oro Cobra Co. is driving an adit at the mine at Red Mtn., near Cisco.——The management of the Bellevue mine is sinking the shaft and blocking out ore preparatory to stoping.

SHASTA COUNTY.

Experimental work is being carried on continuously at Heroult under Professor Lyon of Stanford University. A large furnace will soon be ready for operation. This is built on the same general design as the small furnace which has given excellent results recently. The latter is being used for further experiments in the manufacture of ferro-alloys.——Construction work has been started on the by-product retort plant, and large quantities of wood are being delivered under contract by the Northern California Lumber Co. This plant will manufacture charcoal for the furnaces, and save tar, turpentine, acetate of lime, and other by-products resulting from the distillation of the wood. A. N. Johnson is in charge of the construction of this plant.——Shipments are being made from the Golinsky mine to the Mammoth smelter.——At Coram an increasing number of mechanics and laborers is being put to work on the side-

tracks, and other preparations are being made to start smelting operations shortly.

TUOLUMNE COUNTY.

The Tarantula, Omega, and Western Extension group, near the Eagle-Shawmut mine, has been bonded to C. A. Man and Joseph Russell. It is reported that the properties will soon be worked.——Spencer McCready has leased the property on the county road from Sonora to Shaws Flat. The property has an adit 900 ft. long. Development will be started at once.——The Gilt Edge placer mine, east of Sugar Pine, started work last week.——The Longfellow mine also resumed operations with a small force.

A large pocket has been found in the O'Hara mine. The value of it has not been determined, but fine specimens of gold have been taken out.

TRINITY COUNTY.

Thirty men are working at the Golden Jubilee mine on Coffee creek, and a quantity of ore has been extracted. The new mill is nearly completed and a cyanide plant is under construction. The old mill, consisting of two Huntingtons, is quite inadequate to treat the output of the mine.——At the Bonanza King from 30 to 40 men are employed. Ten stamps are working.——A gravity tram is being built at the Strode mine to transport ore to the mill.——A few men are working at the Yellow Rose of Texas mine near Carrville.

YUBA COUNTY.

J. C. Campbell has secured an injunction in the Superior Court to restrain the locators of the bonanza recently discovered in Brown's valley from removing ore. It is claimed that the discovery was made within the boundaries of the Campbell ranch.——The attorneys of the Anti-Debris Association have commenced suit against several people mining by the hydraulic process, and injunctions will be served against the defendants.

COLORADO.

CLEAR CREEK COUNTY.

(Special Correspondence).—An important discovery has just been made on the Colorado Central, Leavenworth Mtn. In carrying a stope from the Ocean Wave level, a streak of ruby silver and polybasite has been uncovered that measures from 12 to 15 in. wide.——Work has been resumed on the McKinley M. & M. Co., Lincoln Mtn. A streak of ore is being followed that measures from 12 to 18 in. wide. The average value of the product is $30 per ton in gold, silver, and lead. The adit is now in 390 ft.——Stoping is in progress upon the Clyde vein, cut 910 ft. from the portal of the Cully adit, a body of silver-lead ore being followed that is from 18 in. to 2 ft. in width. J. J. Culley is manager.——The men are within 15 ft. of breaking through to the Seven-Thirty shaft from the west Phillips drift, and great care is being exercised. In the old workings there are 10 miles of levels, drifts, and stopes, all of which are filled with water.——The machinery for the Linn Con. M. & M. Co. mill was all delivered on the ground this week. Frank Graham is now installing the equipment and hopes to have the plant running within two weeks. The towers for the aerial tramway have been put up and the cable, 3000 ft. long, will be strung next week. Ore is to be treated from the Mineral Chief mine.——The Georgetown adit, the portal of which is on Columbia Mtn., is being discussed. The adit should be 18,000 ft. long. The first 6000 ft. will pierce Columbia Mtn., and then turn toward Democrat Mtn. S. McKarahan is superintendent.——The Crescent M. & L. Co. has secured a lease upon the 15-ton mill below the Moline adit on Democrat Mtn. The machinery is being overhauled, while new equipment, consisting of jigs, tables, and re-grinding machinery, will be installed. The plant is to treat ores from the New Boston mine. A good force of men is being employed in blocking out the reserves. It is reported that this company has secured a lease upon the aerial tramway running from the Moline adit to the base of Democrat Mtn. G. D. Parks is manager.——G. W. Teagarden has been appointed manager of the Ramsdell G. M. & M. Co. Driving is in progress to the west on the Ramsdell vein and a streak of lead ore being followed that is from 18 In. to 2 ft. wide.——B. J. O'Connell, leasing on the Frostberg below the Victoria adit level, is sending out from 100 to 150 tons of ore monthly. The zinc product is being stored until the price of that metal makes an advance.——The Mendota mill is running three 8-hr. shifts, custom ore being treated exclusively.——Lawson & Co., leasing on the Millington, Columbian Mtn., are sending out regular shipments of high-grade silver-lead ore. Stoping is in progress upon a streak that measures from 12 to 16 in. wide that is rich in silver.——A deal is pending whereby the Eclipse adit on Saxon Mtn. is to be taken over by a syndicate of Chicago capitalists. This bore was advanced for 900 ft. a number of years ago, but owing to the death of the owner the property has since remained in idleness. A valuable group of claims is controlled, namely, the Magnet, Choctaw, Bellevue-Hudson, and Jo Reynolds. Steady shipments are being maintained from the Magnet vein, being developed through the Doric adit. A streak of ore is being followed in the stope that is from 1 to 4 ft. across, the average value of which is said to be $193 per ton in gold, silver, lead, and copper.

Georgetown, April 27.

GILPIN COUNTY.

The large electric pump for the Cook mine has arrived.——The Smuggler mill, near Rollinsville, will start soon.

OURAY COUNTY.

The Atlas intends to add 10 stamps to its mill.——The Treasury tunnel will be actively operated soon.——The Joker tunnel has successfully drained the Red Mountain group, and work will start as soon as the road is opened.

SAN JUAN COUNTY.

A 10-stamp mill is under construction on the Little Nations property on King Solomon Mtn.——The Hercules mill will start soon. During the last few months the capacity has been increased 50%, and when started will be worked with three eight-hour shifts. Further development will be undertaken the coming season on the Great Ohio property in Burrows Park district.——The Hamlet Co. plans to double the capacity of its mill in the near future.

SUMMIT COUNTY.

The Wire Patch mill at Breckenridge will open soon with electric power supplied by the Central Colorado Power Co.——The Emmet property on Yankee hill is being put in shape to run.——A new smelter is to be built by the International Mining Co., near Robinson.

TELLER COUNTY.

Three leasing companies are at work on the Mountain Monarch property on Raven hill.——Porter and Co. made a two-car shipment last week from the 400-ft. level of the Anchoria-Leland.——The Kaffirs Leasing Co. has leased the May Brewin, White & Blue, and New Turn claims, a continuous group of 10 acres.——Four cars a week are being shipped by Ramsey & Co., who have a lease on the Dead Pine dump.——Two cars of low-grade ore from the 400-ft. level of the Orphan Belle were shipped last week.——A company of Colorado Springs men has been formed to work some of the dumps near Gillette. They have leased the old Gillette cyanide mill and expect to begin operations next month.——R. S. Wallace has purchased the Anaconda mill.——The Julia V. on Beacon hill will begin shipments at once.

IDAHO.

BONNER COUNTY.

The Panhandle smelter at Ponderay has been leased for five years by the Montana Mineowners' Association, who will increase the capacity.

IDAHO COUNTY.

Placer mining has started in earnest and all properties report an abundance of water.——News comes of a big strike near Oro Grande, where it is reported a vein 14 ft. wide at a depth of 50 ft. shows free gold.——A new slime-plant at Buster was started recently.——A carload of ma-

chinery for the South Fork mine arrived at Stites last week.——The Coeur d'Alene group on Santa Ana creek has been bonded to a Spokane company, and work will be started as soon as the machinery can be transported to the property.——Construction of a 25-ton mill for the Meadow Creek mine is under way.

SHOSHONE COUNTY.

The Surprise Co. has remodeled its mill and resumed work. W. J. McLean is the new manager.——The Imperial, situated above Burke and west of the Copper King, will discontinue work on their upper adit and begin the driving of a 3000-ft. adit at a lower level.

KANSAS.

CHEROKEE COUNTY.

(Special Correspondence).—The development of new lands in the Galena and Badger camps has been especially noted during the past fortnight, and the activity throughout the district has been marked by extensive preparations for prospecting new ground. A discovery of lead ore in the city limits by Lynch & Williams on a lease on the corner of Wall and Sixth streets has created excitement owing to its excellent grade. The ore occurs in a boulder formation in lumps that are so large that one man can hardly handle many of the pieces until broken up.——Another find of importance was made upon the Ohio lease, where upon four lots a company of prospectors has developed a run of ore that mills 12% concentrate which assays 61% zinc. The ore was opened up on a lower level than had been previously worked.——The opening of the Wyandotte land west of the city to lessees has resulted in a number of new producers being developed. This land has just been drained by the erection of a large pumping plant and the assistance of a flume to carry off the waters of a small surface stream which previously discharged its waters into the underground workings through an old cave-in. The ground has been very productive in the 60-ft. levels, but the present work will be carried out at the 100-ft. level.——The Old Dominion Mining Co. has secured the plant known as the Newton, at Playter, and will at once begin the operation of this mine and mill. The recent high waters flooded the workings, and the drainage of the ground has been begun. The mill has been shut down for some time, during which the company carried on prospecting.——The Prudential Mining Co. has re-opened its mines and has started one of the mills. The ore for the present will be concentrated at one plant during the time necessary to open a deposit of sheet-ore recently discovered below the present level.——J. B. Rauch and associates have opened a new run of ore upon the Ohio land near the Central School building. The ore is zinc-blende and mills 10% concentrate.——At the Peacock camp, Dwier & Co. have opened a new body of free ore at 180 ft. The orebody is 20 ft. in thickness and driving has shown an extensive deposit. Two shafts are now down to ore, and when the underground development is carried far enough to supply the necessary ore a concentrating plant will be erected.——Prospecting has been in progress upon the land of the S. H. & S. Co. which has demonstrated an immense orebody, sufficient to run the plant for seven years. In addition to this development between the present mill and the river, the company is drilling some new ground northeast of the mill property.——The Federated Mining Co. has installed a new compressor plant to supply both its properties, and also finished the construction of a new milling plant. The ore will be supplied from a new shaft sunk southeast of the old mill, where at a depth of 180 ft. a rich deposit of zinc-blende was found. During the process of sinking the shaft a layer of water-bearing gravel was encountered which resulted in much damage to the shaft. The difficulty was overcome by puddling the shaft with portland cement.——The Cincinnati Mining Co. has just completed the development work necessary to begin active production. The new mill was but recently erected, and the company will begin its regular operation next month.

Galena, April 22.

MISSOURI.

JASPER COUNTY.

(Special Correspondence).—The rapid development of the sheet-ground deposits west of Joplin has been responsible for the increased production of that camp during the past month. An area approximately 2½ miles long and 1½ miles wide has been thoroughly drilled and prospected, and in a few instances the orebodies developed to the producing stage. The principal work has been done upon the Luke, Glover, Schifferdecker, Hancock, Henderson, and Connor lands. Of these tracts the deposits upon the Luke and Glover lands appear to be most typically 'sheet ground.' The other tracts have deposits of sheet ground and also occasional soft-ground orebodies. To the soft-ground deposits belong the rich orebodies now being mined on the Schifferdecker and Henderson tracts.——The continuity of the sheet ground is shown by the drill records upon 240 acres of the Luke land, where 67 drill-holes were put down without a single blank. The deposits vary in thickness from 12 to 17 ft. Upon the Glover tract, 11 drill-holes penetrated orebodies 7 to 17 ft. thick. In a few of the holes two levels were discovered bearing good milling ore.——The Old Times Lead & Zinc Co. has drilled 52 acres adjoining this land, and the results demonstrate the entire

Slime Plant at Homestake Mill. Designed by C. W. Merrill.

tract to be underlaid with this class of ore. On a sub-lease to the Black Cat Co., two drill-holes showed deposits 22 ft. and 31 ft. thick. The development of this tract has been quickly accomplished and a concentrating plant will now be erected.——On a sub-lease of the Luke land the Cambria Mining Co. has developed an orebody at the 170-ft. level which shows a face 20 ft. thick. The ore runs 5% concentrate, 1½% being galena and the remainder zinc-blende. A concentrating plant has been erected and the property is now actively producing, though there is but 300 ft. of driving yet opened.——The Hero Mining Co. was the first company to begin active work in the new field. Upon its lease 30 drill-holes were put down without a single blank, and one hole showing a deposit 40 ft. thick. This discovery set in motion the prospecting that has made that portion of the district the most active of any camp in the field. Three shafts have been completed into the orebody and the ore is being concentrated upon a 200-ton plant. The ore from the 170-ft. level runs 5% zinc-blende.——On the north edge of Chitwood, two runs of sheet ore have been developed at 171 ft. and 199 ft. by the Pittsburg Mining Co. A concentrating plant has been completed and the plant will begin production at once. A tract of 16 acres has been prospected and thoroughly proved.——Developments of a similar character have added 60 acres to the producing territory of the new camp. This tract adjoins the Luke land just noted. The C. M. Sheldon Mining Co. has prospected the tract and sunk two shafts to the 140-ft. level, where the driving has since been done. Later drilling demonstrated a run of ore at the 170-ft. level, and two other shafts have been sunk to develop the last dis-

covery. The deposit varies from 6 to 15 ft. thick. The lease is now equipped with a 150-ton concentrating plant and is in operation.——A number of other companies and individuals are operating in this new territory, among the largest leases so far developed being that of Jarvis & Co. Upon this lease on the Reisling land 13 drill-holes have already penetrated ore.——A short distance north of Joplin, on the Hancock and Connor lands, Dewing and Allen have developed a body of ore 15 to 18 ft. thick and averaging from 16 to 18% concentrate. The ore was concentrated upon hand-jigs for some weeks, but a concentrating plant is now in course of erection.——The Henderson land, southwest of Joplin, has been one of the best developed soft-ground tracts. The Morning Hour, Big Three, and a number of smaller plants have become bonanza producers.

Joplin, April 28.

MONTANA.

BEAVERHEAD COUNTY.

The Dillon-Argenta Co. put in a new steam-pump and has drained the workings and will at once sink the shaft deeper. It is possible the company will erect a cyanide plant in the near future.

FLATHEAD COUNTY.

It is reported that both the Silver Crown and Porcupine will install new machinery on their properties at Granite Creek.——The old Bear Creek placer, near Libby, has been purchased by Spokane people and will probably be worked.

NEVADA.

ESMERALDA COUNTY.

It is reported that a custom mill will shortly be built at Reservation.——Knierim & Sons report encouraging prospects at their gold claims near Reservation. Two shafts are being sunk and both are in fair quality ore.——The Yerington B. C. Co. has purchased a group of eight copper claims from Gilmore & Frederick, and will start development at once.——The total shipments from Goldfield mines last week were 1940 tons, valued at $128,575, or an average of about $66 per ton.

HUMBOLDT COUNTY.

A rich strike is reported on the 165-ft. level of the Mazuma Hills, at Seven Troughs. The vein is said to be 7 ft. wide, and the best of it shows free gold. A number of new leases in the same neighborhood are reported.

CHURCHILL COUNTY.

J. F. Hicks has taken a lease on the Dromedary Hump at Fairview and will start at once with two shifts to sink the shaft to the 250-ft. level.

WHITE PINE COUNTY.

A test run of 100 tons of ore was made last week at the concentrator of the Steptoe Smelting Co., with entire satisfaction to the management.——The White Cloud Co. reports satisfactory progress on the development of its property near the Utah line.

SOUTH DAKOTA.

LAWRENCE COUNTY.

Increased activity is reported at the Homestake. Electricity is being installed in the Pocahontas mill, and the re-grinding plant and a new foundry are under construction.——An 8-ft. vein of rich gold ore was struck in the 300-ft. level of the shaft in the old Cooper ground in Ruby gulch on the property of the Hercules Mining Co.

UTAH.

JUAB COUNTY.

The Raymond-Illinois is replacing the engine which was wrecked last week.——The Yankee is shipping.——The Tetro is working two shifts.——The two large compressors for the Colorado have arrived.——Rich silver has been struck between the 1700 and 1900-ft. levels of the Gemini.——The Knight smelter will be started as soon as the power line is completed.

SALT LAKE COUNTY.

The Utah-Apex Co. has let the contract for driving the Parvenue adit, for the purpose of developing their property as well as providing an outlet for the ore from the Apex mine.——Two shifts are at work on the Butler-Liberal property, opening up new country.——Two new veins have been struck on the Central-Standard Co., one of copper and the other a lead-silver vein.——The Ute copper properties are being developed, two shifts being at work driving the Copper Hill adit.

WASHINGTON.

FERRY COUNTY.

(Special Correspondence).—J. F. Eisom and M. F. Doherty, of Louisville, Ky., have been visiting the Pearl Con. property, in Republic camp, looking into an investment in the Syndicated Deep Mines, Inc. J. L. Harper reports that satisfactory arrangements have been made for financing his project, and that Judge Utz of Indiana, C. C. McChord, and several southern people have become interested and will visit the mines with him in a few days.——The La Fleur Smelting Co. has been incorporated with 1,500,000 shares at a par value of $1 each. Danville, Wash., is the principal place of business. Two-thirds of the stock has been placed in the treasury. Assessments may be levied up to 5c. per share. Two groups of claims are owned by the company, the first being the Telluride, Jim, and Anaconda, and the other the Cuba, Last Chance, Cumberland, and Mountain Lion Fraction, all situated on the northeastern slope of La Fleur Mtn. Negotiations are afoot for the purchase of six more claims. On the Cuba group are two shafts, 60 and 90 ft. deep, respectively. From the bottom of the latter a cross-cut has been driven eastward and another westward which intersects a cross-vein about 15 ft. wide at 40 ft. from the shaft. The ore of both veins is of the same character and assays 2½% copper, $4 to $5 in gold, and 2 to 3 oz. silver per ton.——The Humboldt Mining Co. of Keller district is applying for U. S. patents for the Humboldt group of claims.——There is considerable ore blocked out in the mines of the South Half group of the Colville Mining & Smelting Co. at Park City. The machinery and equipment for the smelter plant are on the ground and will be installed as soon as the snow goes off.

Republic, April 25.

OKANOGAN COUNTY.

The Ruby Mining Co., on Mt. Chopaca, is shipping two carloads of ore per day. The Mountain Sheep, an adjoining mine, has begun shipping; also the Nighthawk company on the opposite side of the Similkameen river.——In the lower adit of the Q. S. mine the vein has been crossed about 300 ft. of ore assaying 4% copper. A power plant on Salmon creek has been completed.——The Palmer Mountain Tunnel & Power Co. is employing 40 men and will put on about as many more by May 1. The mill is being erected and all machinery is on the ground. The water will be supplied by a pipe-line, now under construction, from Touts Coule creek. The adit has been driven 4600 ft. and lighted throughout with incandescent lights. Of the large number of veins intersected no one knows the assay-value of the ore but the company and trusted employees. There are some big iron sulphide veins on the mountain ahead of the adit, and it is believed a consolidation will be the final outcome.——The last report from the Butcher Boy mine, at Chesaw, says that a 30-in. vein of rich ore, some of the best yet encountered, has been developed on the 100-ft. level. No assays have been reported.——The Grant Con. Mining Co., at Chesaw, has driven the No. 2 adit on the Grant mine nearly 850 ft. and cross-cut 80 ft. of the second vein. A body of ore 30 ft. wide assays from $21 to $37 per ton, mainly copper and a little gold. From surface workings on this vein, 35 ft. deep, 180 tons of ore shipped to the Granby smelter gave returns of $19 net per ton, of which the gold contents were $4 per ton and copper $15. The first vein intersected in the No. 2 adit is reported by one of the leading stockholders to be 45 ft. wide and to have an average assay value of $15 per ton.——The operation of the Molson company's mill is retarded on account

of scarcity of water, but it is expected the supply will soon be increased by the melting snow and enable it to run to its full capacity.——Lumber for new buildings and flumes has been ordered for the Bethel group of placer claims on Mary Ann creek, six miles northeast of Chesaw. Preparation is being made for extensive washing of gravel the coming summer.——The shaft on the Copper Matte mine, near Loomis, is being sunk, under contract, to the 200-ft. level.——At the Lucky Knock mine, on Whitestone Mtn., the adit is in 116 ft., with about 125 ft. farther to run for the vein, which at the surface shows 5-ft. width of stibnite. ——The Apache mine, near the Nespelim Indian Agency, is getting ready to ship 50 tons of rich sulphantimoniate ore to the Tacoma smelter. This property may make regular shipments if obstructions in the Columbia river are removed, so as to admit of steamboat navigation from the Apache landing.——In an adit driven since last November by the Antimony Queen Mining Co. on Gold creek, Twisp district, a 43-in. vein of stibnite has been encountered at a vertical depth of about 150 ft. A small smelter plant is being established on the Dixie Queen group, on which the strike was made.

SPOKANE COUNTY.

(Special Correspondence).—A deal between the Montana Mineowners' Association and the Idaho Smelting & Refining Co. has been made here, by which the former association takes over the old Panhandle smelter at Ponderay, Idaho. This has been pending for several months, during which time several conferences have been held in New York, Helena, Spokane, and the Coeur d'Alene between J. Herbert Anderson, controlling owner of the plant, and representatives of the Montana mine owners. By the closing of this deal W. A. Clark, W. G. Conrad of Great Falls, Montana, Marcus L. Hewitt, E. A. Spriggs, Thomas L. Greenough, owner of the Snowstorm, and others, acquire immediate possession of the smelter on a five-year lease and option. The plant has been closed since the flurry last fall, although it has been undergoing extensive repairs during the last few months in expectation of being operated this spring. It was begun six years ago, but was not completed till J. Herbert Anderson and associates bought the control in the Panhandle Smelting Co., which owned the plant a year ago, and completed it, at a cost of $40,000. A trial run of six months was made on Montana and Coeur d'Alene ores, and was stopped only with the general depression and scarcity of money last fall. In January the old company capitalized at $5,000,000 was reorganized under the name of the Idaho Smelting & Refining Co., and the capital decreased to $2,000,000. At that time, it was expected to blow in one of the furnaces by the middle of February, but with the organization of the Montana Mineowners, following the visit of J. H. Callbreath, the secretary of the American Mining Congress, an effort was made to join the Montana men who had subscribed $100,000 for an independent smelter, and the matter was taken up with the gentlemen named above. On April 16 the deal was closed, and the new directorate chosen, which consists of J. Herbert Anderson, president; Marcus L. Hewitt, Basin, Mont., vice-president; S. B. Phillips, Spokane, secretary and treasurer; A. E. Spriggs, Helena, Mont.; W. G. Conrad, Great Falls, Mont.; T. L. Greenough, Missoula, Mont., and Albert Wunderlich, St. Paul, Minn. C. C. Titus, formerly in charge of the East Helena plant of the American Smelting & Refining Co., will take immediate charge of the smelter at Ponderay and begin operations. The name of the new company will be the Montana & Idaho Smelting Company.

The Ponderay plant is most favorably situated for the economical assembling of ores and fluxes. Through the townsite on which the smelter is built run the Northern Pacific main line, the Great Northern main line, and the main line of the Spokane International. By means of these roads the coke from Fernie, B. C., the copper and other ores from Montana, and the silver-lead ores from the Coeur d'Alene can be brought by direct haul to the company's bins. It also owns a steamer and barges on Lake Pend d'Oreille for the transportation of iron and lime from its own deposits down the lake. In addition to these features in its own favor, it will be the means of giving a market for many small mines of the Coeur d'Alene which have heretofore been handicapped by the high charges of the trust smelters. Many small mines along the lake which are hardly past the prospect stage will also be afforded the chance of development, and several of these now have ore sacked ready for the furnaces of the smelter. The plant is at present of 250 tons daily capacity. This will be at once raised to 500 tons, and to 1000 before the close of the summer. Facilities for the smelting of copper will also be added later.

Spokane, April 25.

CANADA.

ONTARIO.

The long idleness of Anaconda and many other copper mines in the West, which turn out a large amount of silver as a by-product, has caused active competition among smelters for the Cobalt silver ores. More smelters are now bidding for ore from the Cobalt mines, and in consequence the producers are enabled to obtain more satisfactory prices. Since Jan. 1 the following smelters or smelters' agents have been regular buyers of ore from the Cobalt camp: The Canadian Copper Co., Copper Cliff, Ontario; Del Oro Mining & Reduction Co., Del Oro, Ontario; Consolidated Mining & Smelting Co., Trail, B. C.; American Smelting & Refining Co., Perth Amboy, New Jersey; U. S. Metal & Refining Co., Chrome, New Jersey; Pennsylvania Smelting & Refining Co., Carnegie, Pennsylvania; Anglo-French Nickel Co., Swansea, Wales; R. C. Farrell & Co., Glasgow, Scotland; and the Beer-Sandheimer Co., Hamburg, Germany. According to the weekly report of the Canadian Bureau of Mines, the principal shippers to these smelters since Jan. 1, with the amount of their shipments, have been as follows: Buffalo, 517,520 lb.; Conlagas, 380,910; City of Cobalt, 228,080; Foster, 168,600; Kerr Lake, 330,710; Temiskaming & Hudson Bay, 539,000; Temiskaming, 237,250; Tretheway, 487,116; O'Brien, 1,448,190; La Rose, 1,437,252; McKinley-Darragh, 1,002,400; Nipissing, 943,430 lb. of ore, and Cobalt Central, 136,310 lb. concentrates, equivalent to 1,090,480 lb. ore.

BRITISH COLUMBIA.

Following is the tonnage of ore shipped from and crushed at the mines of Rossland for the week ending April 18, and for the year to the same date:

Mine.	Week.	Year.
Centre Star	3,100	53,018
Le Roi	1,365	26,534
Le Roi No. 2	550	9,565
Evening Star	....	428
Blue Bird	....	30
California-Giant	....	60
Totals	5,015	89,673

At the smelter of the Consolidated Co. there was received during the past week 5839 tons of ore. Besides the ore from Rossland, shipments from other mines were received as follows: St. Eugene, 445 tons; Snowstorm, 919; North Star, 36; First Thought, 292; Standard, 45; Rambler-Cariboo, 22; Vancouver, 20; Arlington, Slocan, 18; Ruth, 39; Whitewater, 21; Hewitt, 22; Silver Cup, 33; City of Cobalt, 62; Nancy Helen, 41; Maggie, 3 tons.——At the Granby smelter at Grand Forks there was received during the week 22,239 tons of ore from the Granby mines at Phoenix. The receipts at the Le Roi smelter at Northport during the past week consisted of 1365 tons from the Le Roi mine. The total smelter receipts at the three plants at Northport, Grand Forks, and Trail were 28,942 tons. The district shipments were divided as follows: Boundary, 22,329; Slocan-Kootenay, 1588; Rossland, 5015 tons.——A well defined ore-body has recently been uncovered on the Gallagher property, near Ainsworth. The vein is 3 ft. thick and is soft iron carbonate carrying silver and gold. It is believed that this body is the source of the high-grade ore shipped from this mine in 1899.

Special Correspondence.

LONDON.

Sons of Gwalia.—Mount Boppy.—Spanish Operations of John Taylor & Sons.—Hand-sorting and Concentration.—Conditions in Western Australia.

The Sons of Gwalia mine in Western Australia continues to make a good profit on the comparatively low-grade ore now found in the mine. During the year 1907, 156,034 short tons were milled, yielding 33,072 fine ounces of gold. The cyanide plant produced 22,982 oz., making the total yield 56,054 oz., which is at the rate of 30s. 6d. per ton. The total income was £238,350, and the working expenditure £130,073, the latter corresponding to 20s. 1d. per ton. In addition, £38,244 was spent on mine development, construction, and equipment. After paying London expenses, income tax, etc., a net profit of £61,967 was made, and dividends to the amount of £65,000 distributed, being at the rate of 20% on the capital. The ore reserves represent about two years' supply, and development work continues to open up the mine in a satisfactory manner. Owing to the recent developments in the south end of the workings, and the southerly strike of all the known ore-shoots, it has been considered advisable to take up further ground to the south in order to protect the pitch of ore-shoots in that direction.

The itemized costs of working are given very fully in the report of the company, as is the case with all companies managed by Bewick, Moreing & Co. It is not my intention to refer to these in detail, but I wish to enlarge on a subject raised while discussing the report with an American mining man now visiting this country. This is the use of the words 'mill' and 'milling,' a point in nomenclature where we might introduce uniformity. In America the word 'mill' includes the whole of the crushing, concentrating, and extraction plant; while elsewhere the tendency is to confine the word to the stamp-mill. For instance, in this Sons of Gwalia report, the cost of treatment is subdivided into the following sub-heads: Rock-breaking, ore-transport, milling, concentrating, roasting, cyaniding, fine-grinding, filter-pressing, etc. The word 'milling' is restricted to crushing and recovery by amalgamation in a stamp-battery. In England we do not as a rule refer to a cyanide mill, or a concentrating mill, preferring to use the word plant. But there are many differences between English and American terms.

There is an idea in America that John Taylor & Sons are almost entirely connected with Indian mines. This is of course a huge mistake, both as to the past and the present. This firm has two mines in Australia, one the Mount Boppy in the Cobar district of New South Wales, and the Tasmanian in Tasmania. The Mount Boppy makes an excellent profit out of low-grade ore, and it is interesting to compare the results with those at the Sons of Gwalia. I would parenthetically remark that comparisons of this sort are misleading and dangerous. The ore treated during 1907 was 76,339 long tons. In the stamp-mill 10,329 oz. of fine gold was won. By cyaniding 46,134 tons of tailing 11,542 oz. was recovered, and in the slime plant 7583 oz. was obtained from 29,925 tons of slime. In addition, 2147 oz. was recovered from 302 tons of concentrate. The total production for the year was 31,601 fine ounces, which represents a return of 8¼ dwt. per ton of ore crushed. The total income was £133,121, and the expenses in Australia and London, £67,023. Out of this £57,475 has been distributed as dividend, which is at the rate of 47½% on the capital of £121,000. The expenditure on capital account during the year was £8313. In the case of the Sons of Gwalia no expenditure is charged to capital, but the whole is included in the current expense, so that the total profit for the year is not reckoned on quite the same basis. The mine continues to open up well, and on Dec. 31 the ore reserves amounted to 193,858 tons, which is nearly three years' supply. The report issued by the company is as complete as that of the Sons of Gwalia, if not more so. Since the formation of the company in 1899, progress has been uniform, and from 1903 onward the dividends have risen gradually from 35 to 47½%. The total production of gold to date has been 144,081 fine ounces, realizing £589,960, while the amount distributed as dividends has been £262,282. This is an example of economical administration in the treatment of low-grade ore that compares favorably with any similar mine in Australia.

Another of John Taylor & Sons mines is in Spain, ten miles from Cordoba. This is the Cerro Muriano, a low-grade copper property. It was acquired five years ago and has been opened up by Henry F. Collins. For some time Capt. Tamblyn, who is now manager of East Pool in Cornwall, was the director of underground operations. The company is further strengthened by having William Frecheville as chairman. It has by no means been an easy mine

Western Australia.

Conditions in Western Australia.

The Sons of Gwalia mine is in Western Australia, and I have had occasion to refer to the conditions there. Mr. Hamilton Smith, who has been in charge of the Sons of Gwalia mine for many years, has just returned to Australia, and I have had a talk with him. He says that the labor conditions are very bad, and that the men are not working more than half time. The cost of living is very high, and the men are not earning enough to live on. The mine is working at a loss, and the company is trying to reduce the cost of production. The mine is now working at a depth of 1,000 feet, and the ore is getting harder and harder to mine. The company is trying to open up new ore-shoots, but so far without success. The mine is now working at a loss of £1,000 a month, and the company is trying to reduce the cost of production. The mine is now working at a depth of 1,000 feet, and the ore is getting harder and harder to mine. The company is trying to open up new ore-shoots, but so far without success. The mine is now working at a loss of £1,000 a month, and the company is trying to reduce the cost of production.

to open up, and the financial resources needed increasing recently. Before settling upon the method of raising new capital the advice of another mining engineer, Alexander Hill, was taken. His examination has proved that there is ready for stoping 100,000 tons of ore carrying 2¾% copper. He estimates that the working cost in producing the copper will be 17s. per ton of ore, if 150 tons per day be dealt with. The monthly output of copper would be 103 tons, which at £55 a ton should realize £5665. The working profit would then be about £1400 a month. A 100-ton unit of the plant has been erected, and the smelter is now being constructed. The funds being raised will be devoted to the provision of further plant and the continued development of the mine. With this object preference shares are being issued in order to raise £56,250. The directors and their friends have already subscribed for nearly half the issue, and the remainder has been underwritten. The terms on which the issue is being made are onerous, and show how difficult it is nowadays to raise money for mining operations. The capital issued hitherto consisted of £225,000 in 225,000 shares of £1 each. In order to raise additional

capital 260,000 new preference shares of 6s. each have been created. These preference shares carry the right to all profit distributed as dividend up to the sum of £150,000 in the aggregate in any year, and to one-half the surplus so distributed in any year; also in the winding up they are entitled to £150,000 out of the assets before any payment is made on the ordinary shares. Mr. Hill makes some interesting remarks regarding the relative value of hand-labor and machinery. To an American it may seem strange that Mr. Hill should recommend that concentration should be effected as much as possible by hand-sorting, to be done by women and children, and that only the refuse from such selection should be sent to the concentrators. But this advice is given by a mining engineer who knows mining conditions in all parts of the world, and it is to he assumed that he speaks out of an experience of economies achieved in widely separated mining regions.

A late publication from the Western Australia Mines Department gives full details of mining operations in that State during 1907. The number of men working totaled 18,548, including 1523 diggers. Out of this number 5646 were working in the Kalgoorlie district, where the mines in 1907 treated 1,630,000 tons of gold ore, valued at $19,-

Kalgoorlie.

967,000, while the grand total to date is $199,672,000. The tonnage treated in all mines in the State amounts to 260,000 monthly. Other minerals produced in 1907 were: 1623 tons of black tin, worth $793,000; 18,978 tons of copper ore, worth $900,000; 142,372 tons of coal, worth $275,000. Apparently there was no production of tantalite from the Greenbushes field in the southwest, where it occurs with the tin. In 1906 the production of tantalite was 88 tons, worth $6[illegible]. During February there were no developments of much importance on the Golden Mile, except that better ore was struck at the 900-ft. level in the Perseverance; and the Horseshoe had an encouraging strike in the bottom level. The value of the ore at the 2200-ft. level in the Great Boulder keeps high. The February output from all mines in the State was valued at $3,180,000. January dividends were $1,025,000; February, $38,500; March, $680,-000. Many attempts have been made to test at greater depths in the north end of the field, that is, three miles from the big group. This part is rather different to the other belt, as the lodes are mostly quartz in diorite. Several companies have failed to make profits, although a number of tributors are doing fairly well. Several public meetings have been held, and the Minister for Mines was asked to grant a subsidy and erect a sulphide reduction-plant in that district, but he was not impressed with either scheme. It appears now that something will be done with local capital. Rich spots are constantly being struck there, but it does not seem as if permanency is assured.

The water consumed in February by the Kalgoorlie mines amounted to 28,325,000 gal. The Mines Water Trust pays the Government $1.20 per 1000 gal. for ordinary purposes, and for pumping the residue away from the mills the price is only 36c. per 1000 gal. The day of conveyor belts for making high and dusty dumps with mill tailing is nearly ended.

DENVER, COLORADO.

Progress in San Juan District.—Conditions at Leadville.—Trial at Durango.—Cripple Creek.—Damages Awarded United States Reduction Company.—Tunnel Scheme at Granite.

Weather conditions are such that practically all the properties in the San Juan district that are to be worked this season are active. The tramways wrecked by the snow-slides of the early spring are being repaired, and the numerous mills start as fast as water becomes available. The properties along the line of the new railroad from Silverton to Red Mountain are stocking ore while awaiting the completion of that important spur line. A new mill has been contracted for by the San Juan Smelting & Refining Co. for its Henrietta mine. The Colorado Iron Works Co. is to do the work. The Green Mountain Mining Co. of Silverton has paid most of its debts and resumed operations with a small force.

The Leadville miners are still working with very small forces. In the downtown section all the shafts are idle. The low price of lead and zinc keeps this camp from producing its usual tonnage. From the surrounding district, however, much ore is being hauled in as the roads become passable. Work on the Dinero tunnel is progressing rapidly. Lessees are advancing the old Garibaldi tunnel at the head of California gulch, and a small vein has been cut. Present conditions indicate a dull season. There can be no improvement unless the metal market advances.

The trial of Joseph Vanderweide and William Mason for the murder of Joseph Walker, United States secret service agent, is in progress at Durango. The plea is self-defense and justification. The case is being fought bitterly on both sides.

Several new and important finds have been made by lessees in the Cripple Creek district during April. A prospecting permit has been granted by the Buffalo & Cripple Creek Gold Mining Co. to a party of local miners who contemplate work on the Newell tunnel in Grouse Mtn. The property, which is very low in grade, has been idle for several years. The Franklin Leasing Co., which secured a lease on the entire holdings of the Gold Sovereign Co. from the former management, and then had to defend its rights in court against the new managemnt, has its affairs settled and is shipping ore. The Elkton Con. M. & M. Co. has paid its regular 1c. bi-monthly dividend and an extra ½c. divi-

dend. The total dividends of the company to date amount to $2,079,640. A new organization, known as the Colorado Milling Co., has been incorporated, with a capital of $20,000. Leases have been secured on the Kimble dump and the dump of the old Gillett cyanide mill. The Gillett plant will be used for treating the rock from the dumps named.

The United States Reduction & Refining Co. has been awarded $60,000 in its suit against the Denver & Rio Grande Railroad Co. The suit, claiming $250,000 damages, was instituted as a result of the burning of the reduction company's National mill at Florence two years ago, the mill being set on fire by sparks from a passing engine.

Much work is going on in the vicinity of Idaho Springs. The Black Eagle mill on Chicago creek has been remodeled and started at full capacity. Repair work is in progress on the Salisbury mill, belonging to the Stanley Mines Co. A test run is to be made on the ore from the mine. The Lone Tree property at Freeland has been taken over under bond and lease by E. M. Moscript and associates, and they have started work in the Teller tunnel. Work has also been resumed on the Rockford tunnel. A raise is being made from the tunnel to the old workings of the Donaldson mine.

A statement issued by the board of directors of Stratton's Independence, Ltd., under date of April 11, summarizes the report of Philip Argall, consulting engineer to the company, announcing the completion of the new mill, and its satisfactory operation. The mill has a capacity of about 300 tons per day, and cost approximately $230,000. The ore on the dump, aggregating 600,000 tons, will be treated, in addition to the regular output of the mine. Regarding the proposed introduction of the caving system of mining, Mr. Argall says, "it will be necessary to take one level at a time and begin work at the farthest point from the main shaft, that is, the northern part of the property, starting the first 'cave' near the property line, preferably on the first level. When this cave is exhausted of profitable ore, another cave can be started nearer the shaft, and two or more can be operated simultaneously on separate veins. The object in each case will be similar, namely, to begin caving at the farthest point from the main shaft and gradually work back to the limits of pay-ore, extracting all the ore possible by drawing the 'caves' and leaving the ground and level behind completely caved and exhausted of pay-ore. When No. 1 level is so worked, caved, and abandoned, No. 2 can be taken up and treated in a similar way, and so with the deeper levels. If the main 'cave' on No. 5 level were first drawn, the 'cave' would soon pass into the hanging wall of the veins, and bring down barren country, as well as destroy completely the superincumbent levels. Furthermore, by caving the upper levels first, the lower levels as opened can be worked under lease, while the caving system is in full swing. The lessees can mine all the high-grade streak on the lower levels, but they must properly timber and secure the ground opened."

SALT LAKE, UTAH.

Sevier to be Sold at Auction.—Utah Apex Contract.—Ohio Copper.—Bingham Central Railway Bond Issue.—Incorporation of Bingham Mines Company.

The Sevier Consolidated properties in Piute county have been ordered sold at a receiver's sale to satisfy obligations approximating $187,500. The company was promoted by an Eastern syndicate headed by Seymour W. Tulloch of Washington, D. C., and expended nearly $900,000 in the purchase of mineral lands, mine, mill, and power equipment; but made the very serious mistake of not employing the services of competent mining engineers. The Sevier mine is regarded as being one of the best gold propositions in Utah, but has been handicapped by the lack of experienced talent.

The Utah Apex Mining Co. has let a contract to extend the Parvenue adit in Bingham, which will open the ore-bodies from 800 to 1000 ft. below the present workings. The present length of the adit is 2600 ft. and is to be continued as far again.

Development work in the Ohio Copper mine in Bingham has continued as usual, and the Mascotte adit, which is to become the avenue through which ores will be brought to the surface in the future, has been completed almost to the point where a raise is to be made to connect with the main shaft. The adit has been widened in places and double-tracked to permit the passage to and fro of ore trains which are to be propelled by electric power. Ohio Copper is one of the big mines of Bingham, but it has been held back on account of the financial entanglements of F. Augustus Heinze. It is believed, however, that Mr. Heinze is emerging from his difficulty, and that his plan to finance the Ohio, and build a railroad and smelter will be carried out. Evidence of this is furnished by the filing of a mortgage in the Recorder's office of Salt Lake county on the 25th in favor of the Metropolitan Trust Co. of New York for $3,000,000 from the Bingham Central Railway Co., organized prior to the financial upheaval in the latter part of last year. The railroad company gives as security for the above amount 6% 40-year gold bonds, as a first mortgage on its property in Salt Lake county redeemable in 1912, at the option of the company, at 105%. The purpose of the issue is for

Utah.

the construction, acquisition, and equipment of its line from Salt Lake City to Bingham, together with its branches and extensions, and for the payment of debts contracted and to be contracted in such construction, and in acquisition of other properties. For constructing that portion of the road in the Bingham district, and for tunneling through and under the properties of the Bingham Consolidated Mining & Smelting, the Ohio Copper, and the Fortuna Mining companies, the road is bonded for $1,000,000, or $250,000 per mile. For regular track-laying and other construction outside the Bingham district, $900,000 is set aside. The sum of $250,000 is to be used for additional equipment, and $500,000 may be used for securing additional trackage and extensions. Mr. Heinze's scheme has been to connect Salt Lake City with Bingham by an electrically operated road, with branches to the site of the proposed smelter west of Garfield, on the south end of the Great Salt Lake. The railroad is to enter the heart of the Bingham camp through the Mascotte adit.

Advices from the East indicate that the proposition to reorganize the Bingham Consolidated Mining & Smelting Co., under the name of the Bingham Mines Co., will be carried out as planned. Holders of more than 70,000 shares of stock have deposited their certificates with the Federal

Trust Co. of Boston, and the remaining shareholders have until April 30 to deposit their stock.

Ore shipments from the Park City district last week amounted to 691 tons, the contributing mines and amounts being: Daly Judge, 339; Silver King Coalition, 352 tons; while the shipments from Tintic amounted to 51 carloads, as follows: Bullion Beck, 2; Centennial Eureka, 44; Eureka Hill, 1; May Day, 2; Yankee Con., 2. The May Day resumed operations during the week, having been out of commission since about Jan. 1. The Grand Central and a number of other mines of the district will resume within two weeks, and will ship to the new Tintic smelter, which will go into commission in June. The ore-purchasing department, however, opens for business May 15. Announcement has been made that the United States Smelting, Refining, & Mining Co. will begin ore purchases about June 15.

BUTTE, MONTANA.

April Production of Copper.—Independent Smelter for Montana Ores.—Plant Acquired at Ponderay, Idaho.—Rich Ore-Find at Buxton.—Barnes-King.

The mines of the Butte district produced in April about 21,530,250 lb. copper, an increase over the March production of 3,403,000 lb. It is probable that May will witness an output of 27,000,000 lb. or more. The various companies contributed to the April total as follows:

Companies.	Ore. Tons.	Copper. Lb.
Boston & Montana	93,000	6,510,000
Anaconda	84,000	5,712,000
Butte & Boston	9,750	633,750
Washoe	9,900	693,000
Parrot	4,500	337,500
Trenton	6,000	366,000
North Butte	37,500	3,750,000
Butte Coalition	24,000	1,968,000
Original	12,000	1,080,000
Miscellaneous	6,000	480,000
Totals	286,650	21,530,250

The following figures show the daily ore tonnage, yield of copper per ton, and the daily average copper output:

Companies.	Tons.	Per ton. Lb.	Production. Lb.
Boston & Montana	3,100	70	217,000
Anaconda	2,800	68	190,400
Butte & Boston	325	65	21,125
Washoe	330	70	23,100
Parrot	150	75	11,250
Trenton	200	61	12,200
North Butte	1,250	100	125,000
Butte Coalition	800	82	65,600
Original	400	90	36,000
Miscellaneous	200	80	16,000
Totals	9,555		286,650

The Montana Mine Owners' Association, which was organized several months ago to furnish smelting facilities for its members independent of the American Smelting & Refining Co., has secured control of the smelter of the Idaho Smelting & Refining Co., situated at Ponderay, Idaho, on Lake Pend d'Oreille, and will increase the capacity of the plant from 250 tons to 1000 tons per day, giving employment to about 300 men. It is proposed to spend $100,000 on the improvements, and the plant will be equipped for treating copper, a refinery being added. The name of the operating company is to be changed to the Montana & Idaho Smelting Co. The smelter was built six years ago, but because of the opposition of the smelter trust, it is alleged, it has been prevented from achieving success. The Montana association has a five-year option on the plant, the price increasing as payment is deferred. If the option is taken up the first year it will cost $1,050,000, but in the fifth year it will have increased to $2,100,000. Immediate voting control of 55% of the stock is secured by the association, and the plant is to be operated on a basis of 15% net profit to the stockholders on all the ore treated. The smelter has connections with three railroads, and its location is said to be ideal.

An important discovery is reported from a new district 10 miles south of Butte in the Summit mountains, about two miles from the station of Buxton, on the Oregon Short Line railway. A rancher named Erick Rehen has been doing assessment work on some claims for 18 years, but never knew the value of the ground. Three months ago Peter Lackner, a young miner from the Lake Superior country, worked for the old man a week and then bought him out. There are 14 different leads in the ground. On one of them Rehen has been running a drift, which is 700 ft. long. The lead is from 60 to 100 ft. wide and the drift is on an orebody 3 to 4 ft. wide which assays from 3 to 4% copper, 20 to 25% lead, 20 to 30 oz. silver per ton, and 50c. to $4 in gold.

The March clean-up of the Barnes-King mine was $26,000. That for February was $19,000, and it is expected that the clean-up for April will be as good as that for March. The mine is now just about paying expenses.

While the Boston & Montana Co. was shipping its ore to the Washoe smelter at Anaconda that plant was run to its extreme limit and for a week or so has been turning out copper at the rate of about 20,000,000 lb. per month. It is reported that before it became necessary to treat Boston & Montana ore at the Washoe, on account of the wash-out on the Great Northern railroad between Butte and the Great Falls smelter, the Washoe smelter was turning out copper at the rate of 16,000,000 lb. per month, which was within 2,000,000 lb. of its highest record before the big slump in prices.

The Rarus mine of the Butte Coalition Co. is daily developing into a greater producer. On the 1700-ft. level a body of copper glance 2 to 4 ft. wide has been opened a distance of 600 ft. The glance assays 60% copper and there are 200,000 tons blocked out, giving 240,000,000 lb. of copper.

JOHANNESBURG, TRANSVAAL.

Lode Penetrated by City Deep Shaft.—Good Assay-Values at 3000 Feet.—Consolidation of Companies.—White Laborers to Work in Rand Mines.

The event of the week on the Rand was the striking of the reef in the City Deep shaft. For many days past, all eyes have been directed to this shaft, as it was known that the lode was not far away. Many people predicted that the assay-value of the lode when found in this deep-level mine would be poor, on account of the depth of nearly 3000 ft. On the evening of March 24 an 8-in. vein was found, assaying 155 dwt., while another sample taken from the opposite side of the shaft gave 89 dwt. across a width of 6 in. The average assay-value proves to be 11¼ dwt. across a 42-in. working-face. This result is highly satisfactory, and has put new hope into everyone. It is generally believed that this is the 'Main Reef' leader, the lower of the two lodes known to exist in this part of the country. Some weeks ago the shaft passed through the top or 'South Reef,' but the assays showed only a few pennyweights per ton, so that everyone was in fear that the lower vein would be equally poor. The satisfactory assays obtained has put a little life into the stock market, and more business has been transacted since the 'strike' than for weeks previous. On the strength of the good assay-values, the shares of the surrounding deep-level ground have stiffened considerably. Too much reliance should not be put on these two assay results, however, for a mine is not proved by two samples, but considering the fair permanency of conditions in the Rand there can be no doubt that the results are encouraging.

A huge amalgamation scheme was carried at the City Deep annual meeting. Five mines have now joined together to form one large company, the capital of the new company being £1,250,000, divided into shares of £1 each. This

enlarged company will have £450,000 available for the completion of the two shafts, the necessary development and equipment. The amount should suffice to enable the company to reach the producing stage with a minimum of 100 stamps and three tube-mills, capable of dealing with 22,000 tons per month. The plant is to be erected in such a manner as to permit additions when required. The Rand seems to have gone mad on the subject of amalgamation schemes. There can be no doubt that the formation of the deep-level claims into huge properties is sound from an economical point of view, but why many of the outcrop companies, which are on their last legs, should be amalgamated with their neighbors is not so obvious. It would seem a better policy on the whole to let these outcrop companies run their course. But amalgamation is in the air, and at nearly every annual meeting during the past few weeks, one expects to see some reference to consolidation.

After all the agitation on the question of the unemployed, the mines have offered to take on 800 white men from the first of April. Four hundred of these men are now doing 'unskilled' or rough labor in the streets of Johannesburg, so they will not go to the mines unaccustomed to hard work. One month after the first 400 get started, the mines will take on another 400 from the municipality. The main points in the terms of employment are that the white laborer is to do unskilled work above or below the surface, according to the instructions of the manager, his pay for work done being based on the present cost of such work at the mine in which he is employed. The white men are to be provided gratis with tents or other accommodations. The railways are also making every effort to aid the unemployed, and have decided to continue using white men as much as possible in place of Kaffirs. Mr. Wall, the chief engineer, states that from experience whites have proved better on earth-work and plate-laying, but not on maintenance of roads. This employment of whites in the Rand mines for rough labor is an important event. For the second time this experiment is to be tried. The first experiment, made just after the war, was a dismal failure. There were two reasons for the poor showing, namely, the wrong type of man was employed, and he was paid so much per day. In the present experiment these mistakes are to be rectified. The men who are going to the mines have been doing hard work for some time past, and their muscles are therefore in good condition. Then they are to be put on contract, and if a man does not work he will earn nothing.

CHICAGO.

Illinois Coal Mines Still Idle.—Agreement Between Miners and Operators Probable.—Dispute Over Law for Paying Shot-Firers.—Discrimination Against Non-Association Mines.

The coal operators and coal miners of Illinois have not yet succeeded in getting together and the mines are still idle. They are likely to continue to be until the middle of May at least and perhaps longer, but nobody cares much anyway, since there is plenty of coal in the market and prices have not gone up materially. There has been some stiffening of price, and many of the railways and large consumers will be scraping the bins before June, but at present they are optimistic. Meanwhile the negotiations, which began here last October drag on, and the situation changes from day to day. Just at present the difficulty seems to be within the labor organization, and a referendum has been ordered, which is to be taken at once. It looked this week as if the radicals were going to run away with things, which could only result in a bitterly contested strike. Now they seem to be losing their strength and the chances for an early agreement are better. The Toledo convention did not alter things so far as Illinois is concerned, as this State was not represented. Action at Toledo was not actually as conclusive as might be assumed, since it was merely permissive; work may be resumed in Pennsylvania, Ohio, and Indiana if the local differences are settled satisfactorily. In certain districts it is as yet by no means certain that they will be easily adjusted, though no one anticipates serious or general trouble. The Illinois operators stuck to their point that local differences must be settled before a general agreement might become possible.

For the first time in years the operators are better united than the miners. More than 90% of the State's production is now represented in the Association, and a defense fund has been provided. In the preliminary skirmishes the operators have won as much or more than they really expected, and probably a satisfactory agreement would have been concluded before this except that a majority of the miners' delegates came to the convention instructed by their locals to sign no agreement that did not include the payment of the shot-firers by the operators. This is the final bone of contention. On the one hand the miners point to the State law which says that the shot-firers "shall be employed by the company at its expense," and also to concessions by themselves on other points. On the other hand, the operators claim that aside from the payment of the shot-firers, their employment involves a heavy expense on the part of the company; that the law was enacted at the miners' request in the face of a specific contract that neither party would work for legislation materially affecting the terms of the existing contract; that the expense of the shot-firers, since they are required only in Illinois, is a differential against this State; and, finally, since the work was formerly done by the miners, they should either now pay for it or accept reduced pay. They hold that here the equities of the case warrant the practical nullification of the clause of the law regarding payment by assessing the cost back on the miners. The justice of this has been recognized heretofore by the miners, and by agreement they have furnished the money to pay the shot-firers. Unfortunately some operators, unfriendly to the law, have made the matter as burdensome as possible, or at least are charged with doing so, and the miners, to protect themselves, have given their delegates iron-clad instructions.

The second point of disagreement was with regard to the independent mines. Curiously enough the operators have been fighting for, and practically have won, a closed shop, though it is not polite to insist on that point. The status is this: Association mines employing union men are solemnly guaranteed the right to employ non-union men if they choose, but this is merely to protect against a charge of conspiracy, since the union men reserve the right not to work with non-union men. That is, an operator may employ non-union men if he wants to and can find them, but if he does so, no union man will work for him. Since all or nearly all the miners are in the union the result is that none but union men are employed in Association mines. However, there are a few mines which do not belong to the Association, and which have had separate contracts with the union. The power to start these mines up broke the last strike and defeated the operators, and the threat of making individual contracts has been the biggest club the union has held over the Association. Now the latter has turned and requires either that no union men work in a non-association mine, or else threatens to make no contract at all. By very adroit work they carried their point, and the miners have now shut down all the non-association mines which sell coal. A few, mining simply for the use of the owners (Illinois Zinc Co., etc.), are not affected. Of course too, Mr. Leiter's Zeigler mines, having been run for some years with non-union labor, are not affected.

The conservative element in the union, headed by District President J. H. Walker and National Secretary W. D. Ryan, seem disposed to make an agreement with the operators along satisfactory lines. The outcome of the referendum will be looked forward to with great interest. The fact that so bitter and long-continued a contest can arise where there is no dispute as to wages, hours, or recognition of the union, illustrates the complexity of modern organization, as does also the curious spectacle of the operators, apparently with substantial justification, working for what is practically a closed shop and an evasion of a cost assessed by State law. Evidently at the present time the simple rules of political economy must be greatly modified by the facts as they are.

Concentrates.

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

Garnet is used for abrasive purposes, and is mined in the Adirondack region. The domestic production, which is increasing, amounts to 5500 tons, worth $33 per short ton.

Resuing is a method of mining small veins, in which the country rock adjoining the ore is first broken, and the clean ore broken down afterward. It is an economic method for many high-grade narrow veins.

Maltha is a fluid tar found near Carpinteria, on the shore of southern California. Here a bed of Quaternary beach sand, 20 to 30 ft. thick, is impregnated with liquid bitumen, which forms about 20% of the whole. A layer of richer bituminous shale underlies the sand and is the source of the tar.

A volcanic sill is a variety of lava dike which has been forced horizontally between beds of previous lava-flows, or between stratified rocks following the bedding-planes, or between the tuff and underlying rocks around a volcanic vent. Sills are a phenomenon most abundant in volcanic cones. When the amount of lava intruded in a horizontal position is great enough to float up the overlying rock and form a large mass with a more or less dome-shaped top, it is called a laccolith.

The earth temperature increases at an average rate of 1°F with every 50 to 60 ft. of depth below the zone of invariable temperature (the isogeotherm), which is found at depths, varying with the latitude, from 3 ft. at the equator to 60 ft. in arctic countries. But this rate of increase is not uniform. There are hot and cool spots in the upper rocks of the earth, the temperature in certain regions rising 1° with every 30 ft., and in others, as in the Michigan copper district, increasing at the slow rate of 1° for about each 212 ft. of additional depth. These differences have not been satisfactorily explained, but lower heat-conductivity is supposed to cause the cool spots.

Machine drills are widely used in Western Australia. For shaft-sinking and development work, the heavy ⅝-in. machine is in favor. For stoping, the smaller sizes, 3¼ in. and 2½ in., are used, and where the conditions for work and the hardness of the rock are favorable, the 2-in. machine is employed. The maintenance of a machine in constant work, for renewals of working parts and general repairs, is estimated to average about £6 per month during a life of about 18 months. Hand hammer drills are only used for cutting niches and breaking up large masses in the stopes.

Storage of lime for use in the cyanide process should be under conditions to prevent exposure to sources of excessive carbonic acid, which is apt to be plentiful in the vicinity of many mills, especially when steam-power is generated. Moreover, the amount of carbonic acid produced in the damp places under floors, where much organic matter usually accumulates, is often large. The lime is, of course, inert for the purpose of neutralizing acidity when it has become converted back into the form of the carbonate. Lime may be preserved without carbonatization in tanks after slaking better than in the form of 'quick lime' in lump.

Dynamite should be detonated with a strong cap, in order to develop higher efficiency in the explosive. There is a great increase in power obtained by using a 5-X instead of a 3-X cap. But great improvement in efficiency can be obtained by carefully placing the cap in the end of the primer so that the bottom of the cap shall be in contact with the powder, and not with an open space beneath it. The existence of such a minute air-space seems insigificant, but experiments have demonstrated that it does act as an air-cushion, materially lessening the force of the shock delivered by the explosion of the cap, and the force of the detonation of the powder always bears a direct relation to the initial impact.

Bauxite is a hydrous oxide of aluminum (formula $Al_2O(OH)_4$), occurring in masses accompanying clay or kaolin, and has been formed as an alteration product from other aluminous minerals. It is usually pale yellow or pale brown in color, of an oölitic or pisolitic structure, very soft, and of low specific gravity. The principal American deposits are in Georgia, Alabama, and Arkansas. It has been discovered on the upper Gila river near Silver City, N. M., and in a few localities in southern California. The basic patents under which aluminum is at present manufactured will expire in about a year, when the industry is expected to expand rapidly under the stimulus of open competition. Deposits of bauxite will consequently be in demand.

A make-shift concentrator that will yield good results is the old Gilpin county bumping-table. In its simplest form it consists of a plane surface inclined to about 4° from the horizontal, with flanged sides. The table is made of wood, covered with oilcloth, and is carried on four vertical spring-supports. A cam and tappet underneath impart a reciprocating motion, the amount of the throw being adjustable. The table is moved by the cam in the direction of the downward incline. When released by the cam the spring-supports throw the table against a heavy stop-block, jarring the concentrate upward toward the head-discharge. The pulp-feed is near the head of the incline, and a fresh-water feed is arranged across the width of the table between the pulp-feed and the upper discharge-lip. The old simple canvas-table is also useful with slime, but is of little avail in the concentration of moderately coarse sands. Hand-jigs are used extensively by the small operators in the zinc-lead district of Missouri, and would be valuable for preliminary work elsewhere when the heavy minerals in the ore occurred in relatively coarse particles.

Discussion.

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy.

Psychology of Mining Booms.

The Editor:

Sir—J. H. Curle's honest articles in your columns are always read by me with profit. He has something to say and says it briefly and clearly. The criticism of Mr. Claude Sachs reads like many a prospectus. He seems to voice the spirit of the boom-booster, while Mr. Curle is spokesman for the conservative miner. Mr. Sachs says "when results (proof of richness) from one or two mines in a new district are obtained, those to whom the opportunity is given would be perfect ninnies were they to fail to grasp the chance to acquire ownership in as much of the territory in the district as possible even though the cost might be out of all proportion to visible values." If he said "out of proportion to the extent of several times visible values" his remarks would be endorsed by many conservative engineers, perhaps even Mr. Curle. He also says that under similar conditions "excitement, speculation, and advances in prices far beyond visible or provable values is warranted. The district where one good mine is proved is the best place to find another." I think he will hardly be contradicted on that, either. The question between the two gentlemen seems to me to be in the character of the men who are in the booms and their ability to tell a mine, its prospects, and probable profits. As we all know the chief sufferers in booms are small 'investors,' far from the scenes of activity. "Mining can be a silly speculation or a sane gamble but never an investment." That covers the whole ground. Mr. Curle speculates himself, so do many miners, but he probably does it sanely. The public rarely can, especially in boom times. The evil deprecated by Mr. Curle is the discredit that falls on mining as an industry because of the inability and dishonesty of those who, during booms, advise the investor. As he says, it requires rare courage to hold back in such times.

CONSERVADOR.

San Francisco, April 4.

Variations in Mining Costs.

The Editor:

Sir—I have read with interest the article by J. R. Finlay in your issue of January 4, 1908, regarding 'Variations in Mining Costs.' This is supplemented in your leading columns by some illuminating remarks which are distinctly germane to the subject. Most engineers in the course of their careers have encountered some hard problems relative to cost, either in reporting upon or in the management of mines. Perhaps in the latter instance, where the subject is felt most keenly, is where a former superintendent may have whittled down costs by lavishly charging to 'development' all sorts and descriptions of general costs, the remainder being reported as the 'working costs.' The 'stumbling-block' and 'rock of offense' seem to be in the development account, as Mr. Finlay points out. What is development? Is it not equivalent to mine improvement? In other words, does it not increase the value of the mine through equipment or facilities of operation, and is it not distinctly an asset? Is not this what we invariably find in actual practice? I have in mind an instance where development was charged with an undue proportion of general costs, both above and below ground. Such charges included maintenance of buildings, traveling expenses, and plant maintenance, while underground mine-maintenance and pumping were included, the consequence being that the monthly charge for development was swollen beyond recognition, being actually doubled in cases, while stoping-costs had the appearance of having taken a course for obesity. At times the monthly cost for development was in excess of that for stoping, and this when stoping a wide lode under fairly normal conditions. The development costs were returned as so much per foot, while those for stoping were based on the ton unit. The consequence was that with a change of the management, when both development and stoping were put on the same tonnage basis and general charges were shown separately on the cost-sheet, the reported costs were so discordant with those formerly given as to seem detrimental to the new management. This is one extreme. There are instances in the Western States where no development account is carried at all. The managers, who in this case are also often the owners, argue that if the monthly receipts do not meet expenditures, the sooner they know this the better, and they will quit. Where costs are prepared by managers or consulting engineers for their directors, doubtless a development account will be esteemed necessary as tending to balance expenditure and to regulate operations, performing the function of a fly-wheel to a compressor.

In all examples given of work upon similar classes of deposits, and under like conditions, there should be a definite proportion between the expenditures for development and stoping. While it is true that the costs themselves may not be comparable between the cases in different places, the ratio of expenditure may nevertheless be constant. This being so, irregularity in these items is a fit subject for investigation. For wide deposits the proportion given varies from 9 to 15%—certainly not to exceed 20%; and yet we find costs returned under these conditions where the charge to development is even in excess of that for stoping under fairly normal conditions. Such stoping-costs are then established as a precedent, whereas, in fact, the working costs may be, without depreciation or other charges, from 50% to several times in excess of such quoted costs. Such a premise of working costs is sure to bring disillusion, if not dissolution, sooner or later. It would not be without gain were the profession to indulge in a little exchange of opinion upon the relation of the development account to the operating account in mine book-keeping.

The following questions are tentatively offered:

1. Is a development account a necessity in the practical working of metalliferous mines? If so, is

it essentially an operating charge or only partly so?

2. What is the best method for charging off such development account, and when?

3. What items constitute a fair charge to development, and in what proportion?

4. Are general charges, such as plant-maintenance, building-maintenance, hospital-account and fire-protection, chargeable in part to development, or wholly to mine-maintenance underground?

5. What general accounts are chargeable, and in what proportion?

6. Shall such mining charges as pumping be charged in part to development,

(a) When such development is in no way dependent on pumping?

(b) When pumping is neeessary, as in shaft-sinking, or developing a lower level?

7. Is hoisting chargeable to development for waste hoisted, unless such can be utilized as filling below? When ore is broken in development, if charged to hoisting, what credit should development receive? In either case, would it be advisable not to charge hoisting?

8. When drifts are driven in ore, and raises and winzes are made in blocking out ground, or when cuts are made in ores, are not these fair charges against stoping?

9. In the case of rock-drifts or work that will be serviceable for a number of years, is not such a fair charge against development?

10. In the case of sinking working shafts between levels, these are a fair charge to development account. When a new shaft, entailing considerable outlay, is undertaken, this may be a fair charge to capital account, and is not considered as a revenue account, unless operations are so comprehensive as not to become in any way disorganized thereby.

11. How is it proposed to deal with depreciation charges? Shall we assume a life of from 5 to 10 years and charge per ton of ore what is thus annually written off?

12. As to amortization charges, how is it possible to recognize this in the working costs at the mine? Is not such a matter one for the directors or for the shareholders?

13. Regarding the writing off of depreciation charges, being an important item, often running into a considerable figure, thus largely governing the real profit or loss, is it advisable that this should be controlled by the manager at the mine, rather than by directors at a distance?

It appears to me that under the heading of development should be charged off the underground expenses that cannot be directly or indirectly considered as an expense in the breaking and extracting of ore. Development referring to new work is essentially an asset in the equipment of the mine. An example may be more explicit. A rock-drift, intended to facilitate the working of orebodies for a period of years would be a correct charge against development. Development, finally, is as much a working expense as stoping. The feature, however, that it seems essential to keep before one is that no matter how accounts may be sub-divided, ultimately there is but one source of revenue to meet such expenditure, and that is the value of the ore extracted. All expense, sooner or later, is chargeable to the ore account. Income and expenditure must balance, otherwise the undertaking is being run at a loss, no matter what the balance-sheets may say. The total mining costs include every expenditure, no matter under what subdivision such may fall, whether mining, development, general costs, or amortization.

Such total expenditure divided by the total tonnage gives a cost per ton that is comparable the world over. Any item omitted or curtailed renders the reported cost unreliable and useless for purposes of comparison.

TRIBUTER.

London, April 13.

Foothill Copper Belt of the Sierra Nevada.

The Editor:

Sir—In your issue of March 21, under the above heading, John A. Reid draws an erroneous conclusion in stating with reference to the entire foothill belt that "the ore consists essentially of original sulphides, little secondary material having been formed." This conclusion might be allowed to pass unchallenged were it not that its effect may be pernicious as tending to give undue confidence in the belt as a whole and to discredit the work of others who have examined particular mines and describe the commercial ores as due to secondary enrichment in the upper portion of the sulphide zone and hence probably rather limited in depth. Mr. Reid gives detailed descriptions of two properties, the Copperopolis and Pocahontas, and I have no fault to find with his conclusion that their orebodies are chiefly original sulphides; but he is in error in the sweeping intimation that similar ores are the rule throughout the belt. The foothill copper belt is over 250 miles long, and contains hundreds of old mines and prospects. There is such great variety in the character of the ore deposits that no general rule can be applied. Every deposit must be considered separately and will be found to present some new feature.

In the spring of 1906 I followed the belt from Tulare to Amador county, visiting many of the principal properties, and although, through my notes having been destroyed in the San Francisco fire of that year, I cannot be specific, I remember that I gained the impression that in the portion of the belt southeast from Copperopolis the majority of the orebodies of commercial grade (leaving out of consideration the generally exhausted carbonate and oxide ores in the zone of oxidation) are typical examples of secondary enrichment in the upper portion of the sulphide zone. Bornite and chalcocite are important constituents. Many of the mines have not been carried deep enough to expose the primary sulphides, but in some important cases I believe this has been done. For instance, it is my impression that at the Green Mountain mine in Mariposa county and at the mine on the Daulton ranch in Madera county, the rich sulphides give place at a depth not exceeding 200 ft. to large bodies of low-grade cupriferous pyrrhotite, the primary ore. The Buchanan mine in Ma-

dera county was an important producer at one time, but the base of the enriched sulphide ore has not been reached.

I have made a more thorough study of three old mines on the belt southeast of Copperopolis. At the Victoria mine in Mariposa county there are, below the zone of oxidation (which is from 30 to 70 ft. deep), small lenses of sulphides which in places are nearly pure pyrite, and in others pyrite plus chalcopyrite and chalcocite. I regard this as the primary sulphide ore to which some copper has been added by the secondary enrichment process. The unaltered sulphide zone is not exposed. At the Cavan mine in Mariposa county, the zone of oxidation seems to extend to a depth of about 100 ft. The sulphide ore exposed down to a depth of 172 ft. from the surface has bornite as the chief copper mineral, although chalcopyrite appears in the lower part of a shaft 155 ft. deep. I believe the primary sulphide to have been chalcopyrite very sparingly distributed (along with a little pyrite) in narrow zones of schist and in little quartz masses in the schist. The decomposition of this schist hundreds of feet in depth caused the copper salts to travel downward, gradually concentrating into seams and kidneys of crushed rock which in course of time became quite rich. I never saw a more evident case of secondary enrichment than at the San José workings of this property, as the minerals are those typical of such ores and have been deposited by descending water following lines of weakness in the schist and brecciated quartz. At a mine in Tuolumne county which I recently visited, the zone of oxidation is about 90 ft. deep. Thence to the 350-ft. level, the deepest in the mine, the copper mineral is almost entirely chalcocite. A little chalcopyrite (the presumed primary sulphide) appears with the chalcocite in the deeper mine openings, but it is evident that the bottom of the zone of secondary enrichment has not been reached, unless, indeed, one entertains the revolutionary idea that some of the chalcocite is an original sulphide. Unusual porosity of the ore favored deep penetration by the enriching solutions.

These examples will show that while one man's experience may lead him to think that the workable orebodies of the foothill belt are prevailingly of primary sulphides, another man may gain the impression that the process of secondary enrichment has been necessary at most places on the belt to produce commercial ore. I anticipate that the final review of studies on the entire belt will show that southeast of Copperopolis there will be found comparatively little primary ore of commercial grade; that from Copperopolis northwest, the original sulphides will take a much more important part in the production (although there will in that region also be much secondary sulphide ore), and that the Copperopolis deposit is unlike any other on the belt. In the meantime I must protest against writers forming conclusions for the entire belt based upon a study of only one of the many types of deposit represented throughout this extremely interesting region.

OSCAR H. HERSHEY.

Berkeley, April 3.

Drill Contest on the Rand.

The Editor:

Sir—In your issue of March 28 there appeared a letter on this subject writen by one who signs himself 'Mine Manager.' The gentleman appears to have overlooked the fact that 40% of the holes drilled in the South African stope-drill contest were upcast holes. He says: "The entire contest was based on drilling inclined holes in a perpendicular face." This is not true, for out of the whole four days which each drill had to run, not over an hour was spent by any competitor in drilling inclined holes in a vertical face. This is certainly a very small part of the four days, and furthermore the inclined holes in question were upcast and not downcast holes.

The conditions of the contest were fixed by a joint committee (of which the writer had the honor of being a member) consisting of mine managers, engineers, and drill-manufacturers. Every effort was made to make the conditions equally fair for every type of drill and at the same time to prove the relative drilling power of each type under the different mining conditions found in the numerous mines of the Rand. The entries included six drills of the percussive type, three of the hammer type with air feed, one hammer drill with a screw feed, and two of the Gordon type.

It was on just such upcast holes as 'Mine Manager' considers ideal that the winning drill, the Gordon, did more than double the work of any other competitor. Numerous rules were made in order that no question might arise as to the justice of the results, but the main points were as follows: All holes must be over 36 in. deep; all holes must bottom or finish large enough to take the standard sticks of explosive; all holes were to be drilled approximately as indicated by the judges before the work started.

Each day's work on the surface consisted in drilling for one hour in each of the test blocks, three hours being spent on downcast holes and one hour on flat and upcast holes. Underground one day was spent on drilling downcast holes in an overhand stope and one day in drilling upcast holes in an underhand stope.

L. C. BAYLES.

New York, April 13.

Cornish Pumps of New Design.

The Editor:

Sir—In your issue of January 18, 1908, there is a short description of a pumping plant installed for the Loddon Valley Gold Fields, Ltd., Australia, by E. P. Jones, the designer of this plant. It would be interesting if Mr. Jones would furnish a few additional particulars. The information wanted pertains chiefly to the air-receiver, and to the efficiency of the plant. As the pump is operated by an engine, presumably of the crank and fly-wheel type, the use of an air-receiver and alleviator becomes more necessary than with a direct-operated pump, as in the case of a beam-engine, by which the larger sizes of Cornish pumps are usually operated. The reason for this is evident on account of the velocity of discharge varying throughout the stroke, being 1.57 times the mean

velocity at mid-stroke. This objectionable feature causes shock, which would be detrimental to the pit-work and especially so to the large discharge-valve of a type such as the compound-clack. As the tendency of water under pressure is to absorb air, for which an air-charging apparatus has apparently been provided, what is the idea of the connection to the rising-main with the air-receiver? Is it to control the air-supply, provided too much should be supplied by the automatic air-supplier? What would be the effect without such a by-pass?

I have had experience with a 26-in. plunger pump, operated by a beam-engine and raising water about 250 ft. vertically, where such compound clack-valves were used. Working at about 8 strokes per minute, the water-hammer was so great as to fracture the door, and crack the valve-piece, both in this instance being made of gun-metal. An air-chamber was provided at a branch at the top of the shallow shaft. Unfortunately, when erecting, this piece met with an accident, and a bend was substituted. A remedy in this instance was effected by discarding the clacks and substituting four-beat valves, which, in the writer's opinion, are preferable where exceedingly large valves are required. Water-works engines invariably have large air-receivers, to facilitate the forcing of a great volume of water through long mains with absence of shock. These engines, moreover, represent the highest mechanical efficiency and 'duty' of which the Cornish type is capable, though it is not comparable with the vertical triple-expansion, condensing, three-crank, differential-plunger engine that attains a duty of 160 million foot-pounds of work per 1000 pounds of steam used by the engine, possibly representing the highest economy of the present day.

The next point is in respect of the efficiency of the plant. Mr. Jones remarks, "A Cornish pump-plant of large capacity should give a total combined efficiency of about 80%: this being taken from the throttle valve of the engine to the water delivery." Now, what does Mr. Jones mean precisely by this statement? At first, as the throttle-valve was mentioned, it suggested to me that the steam consumption was taken as the basis of efficiency with regard to the water lifted; or, in other words, the 'duty' of the plant. What is probably meant by giving 80% is the 'mechanical efficiency,' which is the actual or net horse-power of the machine divided by its indicated horse-power, and the quotient multiplied by 100. On this basis we find that small direct-acting steam pumps have an efficiency of about 50%, increasing with the size of the pump to about 80%. Large vertical municipal pumping engines are quoted as having shown an efficiency as high as 96%, and horizontal medium-size crank and fly-wheel pumps an efficiency as high as 90%. The 'duty' of such pumps, on the other hand, based on a consumption of 1000 lb. steam used, is about fifteen million foot-pounds for small direct-acting pumps. Compound direct-acting pumps of five million gallons capacity per 24 hr. should give a duty of about fifty million foot-pounds. Large municipal pumping engines of twenty million gallons per 24 hr. have given a duty of one hundred and sixty million foot-pounds. Such records are only attainable under the best conditions. Perhaps Mr. Jones will be able to give the 'duty' of the plant designed by him, based on the standard steam consumption, or better still, in British thermal units.

Although the action of beam-engines is more constant in velocity, and therefore more favorable for pit-work, would Mr. Jones suggest the advisability of equipping all 'lifts' with suitable air-receivers? And, as the economy of the crank and fly-wheel type is manifestly more economical than the beam, as it admits of more expansions, which in the beam-engine is governed entirely by a consideration for the pump-rods, would Mr. Jones suggest the advisability of adopting the crank-engine in the larger sizes of pit-work, for which the beam-engine is invariably adopted, at least, in deep mining?

The efficiency allowed the electrically driven turbine pump-plant, comprising steam-generating apparatus, is given at 45% for the total combined efficiency. Are we here dealing with 'mechanical efficiency,' or the ratio of work from steam and water ends, otherwise the 'duty'? While up to 65% may be allowed for large rotary pumps, I have no reliable data as to the mechanical efficiency of the modern multi-stage turbine. Possibly someone with the requisite data will be good enough to state what may be expected in the way of 'mechanical efficiency' and 'duty' for a steam-electric turbine pump-plant. Electrically operated turbine pump plants are becoming common nowadays, and in some instances are well spoken of. Doubtless, with regard to economy it is largely a matter of local conditions, and is favored by hydro-electric generation in places where a horse-power may cost $50 per year or less.

Were five million gallons per 24 hr. to be raised 1500 ft. vertically at sea-level, where electric or steam power can be generated at $100 per horse-power year, it is inconceivable that the Cornish pump can successfully compete with more modern steam or electric pumping plants.

In this connection I recall the instance at the Difficultad shaft of the Real del Monte company, Pachuca, Mexico, where a large compound-cylinder beam-engine, of German design, with a rated capacity of five million gallons per 24 hr., pumping through a wrought iron column 3 ft. in diameter, has been successfully supplanted by a four-stage turbine pump, driven by a 750-hp. alternator at 900 rev. per min., pumping through a 16-in. column 2400 gal. per min., against a head of 730 ft. The district, however, favors the use of electrical power.

I am aware that Mr. Jones is not posing as the champion of the Cornish pump. In fact, from his concluding remarks, I imagine that he considers it a somewhat cumbersome and expensive equipment, but capable of good work and fair efficiency, under favorable circumstances, though easily surpassed in both by more modern plants.

OLD TIMER.

Redruth, March 4, 1908.

[We invite further comment from professional men on this interesting subject. EDITOR.]

CYANIDATION OF SILVER ORE IN MEXICO.—II

By W. A. Caldecott.

*The reactions involved in the dissolving of silver from its ores admittedly still require much study before they are clearly understood. The following discussion is rendered imperfect on account of the non-arrival of a parcel of Mexican silver ore, upon which it was intended to carry out tests to develop and confirm the tentative conclusions arrived at from an examination of the properties of artificially prepared silver sulphide. The study is instructive, as apart from its direct interest, it has a bearing upon the treatment of gold ores containing sulphides which dissolve in cyanide solution. It is probable that since the mineral silver sulphide is coarser and more compact than the artificially prepared compound its dissolving in cyanide solution is slower, thus allowing more time for secondary reactions to proceed.

The primary reaction in the dissolving of silver sulphide from its ores may be taken as:

$$Ag_2S + 4NaCy = 2NaAgCy_2 + Na_2S \qquad (1)$$

Another suggested equation is:

$$Ag_2S + 6KCy + H_2O = 2K_2AgCy_3 + KOH + KSH$$

When, however, a certain amount of silver has been dissolved by the above reaction an equilibrium is established and solution ceases. How far the reaction has proceeded before this equilibrium is attained, depends on the amount of soluble sulphide in solution, whether derived from silver sulphide or other sources, and the amount of free cyanide present. Heat also increases the solubility of Ag_2S in cyanide solution. The following table shows the results obtained from a series of argentiferous sodium cyanide solutions of the strengths stated, 100 c.c. of each of which was titrated with 0.1% sodium sulphide solution until a brownish coloration was just produced. A reduction of 0.05 c.c. was made from the reading, so as to give the amount of sodium sulphide that could be added without reacting with the silver present.

Table A.

Free cyanide (as KCy) %	Silver present mg. per litre.	Na_2S required mg. per litre.	Equiv. sol. Ag present as Ag_2S mg. per litre.
0.50	490	5.3	14.7
0.40	392	4.4	12.2
0.30	294	3.1	8.6
0.20	196	2.0	5.5
0.10	98	1.0	2.8
0.05	49	0.7	1.9

An inspection of the foregoing table, in which milligrams per litre may be read as grams per metric ton, shows that the amount of silver sulphide capable of being dissolved as the soluble double alkaline cyanide is approximately proportionate to the amount of free cyanide present, but even with 0.5% solution the quantity of dissolved silver is less than 0.5 oz. per 2000-lb. ton. Further, it is obvious that the introduction, through the presence of a free alkali, of soluble sulphides into an argentiferous cyanide solution from any mineral or other source will result in the precipitation of silver already dissolved. The fact that dissolved silver and other than very small amounts of sodium sulphide cannot exist simultaneously in the same solution serves to explain why working solutions do not show more than traces of the latter when sulphide ores are being treated. With solutions low in silver it is difficult to filter off the very finely divided suspension or colored colloidal precipitate formed on addition of sodium sulphide solution to sodium-argento cyanide solution.

The explanation of how in practice many ounces per ton of silver existing as sulphide in the ore can be dissolved can be explained by the occurrence of secondary reactions, and to these attention may now be directed. They show the conversion of soluble alkaline sulphide first formed into other compounds which do not preclude the further solution of silver, and thus the primary reaction appears to be merely a transition state in the sequence of reactions. No doubt, various of these secondary reactions proceed simultaneously, and the formation of the resultant products indicated has been experimentally proved by their detection in the solution.

The following are the secondary reactions referred to:

$$(a)\quad \begin{cases} 2Na_2S + 2O_2 = Na_2S_2O_3 + Na_2O & (2) \\ Na_2S_2O_3 + Na_2O + 2O_2 = 2Na_2SO_4 & (3)\dagger \end{cases}$$

$$(b)\quad Na_2S + NaCy + O = NaCyS + Na_2O \qquad (4)$$

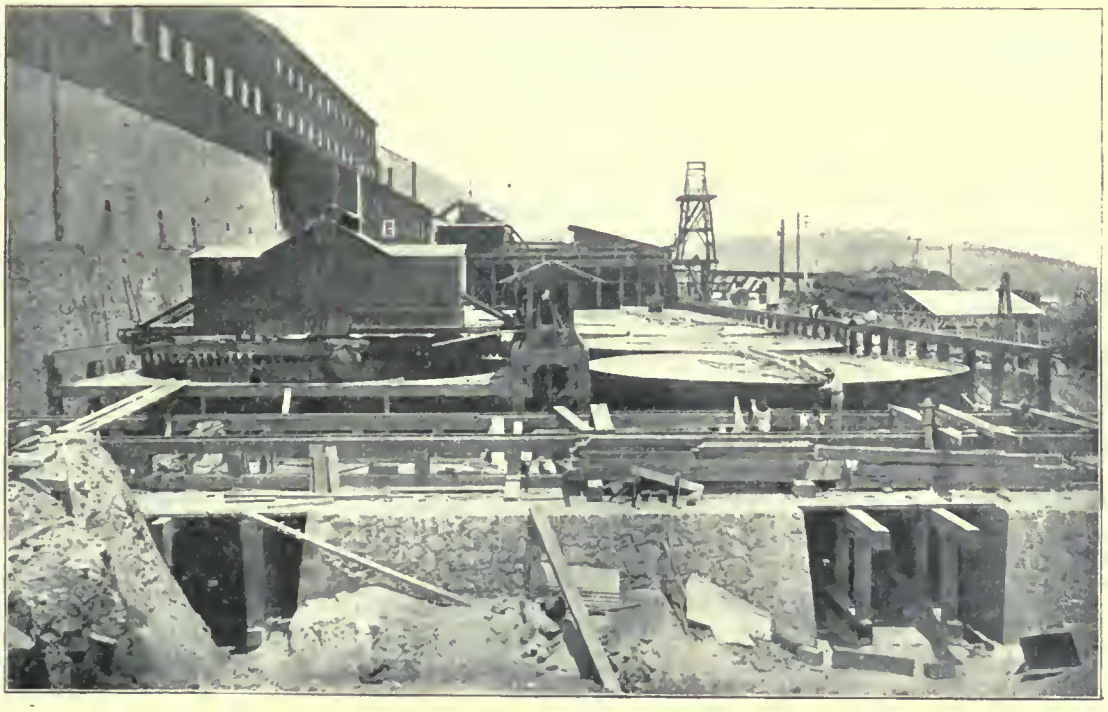
$$(c)\quad \begin{cases} Na_2S + PbO = PbS + Na_2O & (5) \\ PbS + NaCy + O = NaCyS + PbO & (6) \end{cases}$$

The foregoing reactions, when carried to completeness, all involve absorption of oxygen, whereby the utility of aeration may be accounted for, apart from its accelerating the solution of any metallic silver or gold present in an ore under treatment. Reaction (*a*) apparently proceeds a good deal more rapidly than (*b*), and since it does not involve destruction of cyanide, and indeed is not required to proceed further than the first stage, resulting in the production of sodium thiosulphate (itself a silver solvent), this may be considered the most desirable result of aeration. Reaction (*c*) with lead present as suspended hydrate or soluble alkaline plumbite has the advantage of instantly converting the soluble into insoluble sulphide, and also the reaction being cyclical, given sufficient oxygen, a limited quantity of lead salt serves to remove an indefinite amount of soluble sulphide, but this last result is only attained at the expense of free cyanide being converted into useless sulphocyanide. If bad peroxide could be employed as soluble alkaline plumbate, a double quantity of soluble sulphide should be removed as sulphocyanide and insoluble sulphide.

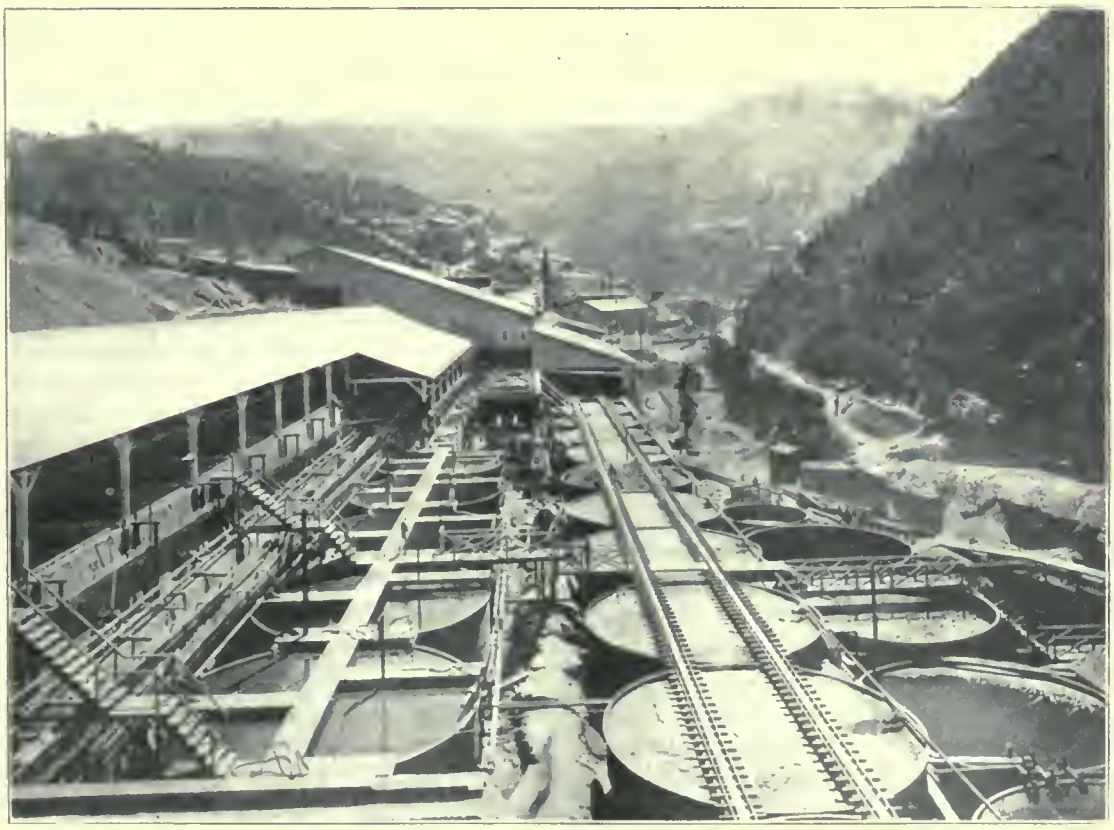
To ascertain whether, in addition to the foregoing reactions, involving absorption of dissolved oxygen, sodium sulphide could be oxidized at the expense of oxygen combined in water, an aqueous 2.97% solution of sodium sulphide was allowed to stand for five days in a filled and closed vessel. At the end of this time no loss of strength could be detected, nor were thiosulphates, nor sulphates present, whereas a parallel test in a closed flask only one-eleventh filled showed on opening reduction of internal pressure, a reduction of strength to 2.85%, and the presence of sulphate in solution.

*Abstracted from *The Journal* of the Chemical, Metallurgical & Mining Society of South Africa, January, 1908.

†See Watts' Dictionary of Chemistry, New Edition, p. 483, Vol. IV.



Cyanide Plant of the El Oro Mining & Railway Co. at El Oro. Blaisdell Excavator in the Left Foreground.



New Cyanide Mill of the Dos Estrellas Mining Co. at El Oro.

Since in Mexican practice little lead seems to be deposited from solutions entering the zinc-boxes it does not appear as if the cycle (*c*) were usually completed, but from a scientific standpoint its possibility is of interest. Apart from any re-formation of PbO, nearly as much lead as there had been silver present as sulphide is required to carry equation (5) to completion.

While the relatively weak solutions included in Table A dissolve silver sulphide in proportion to the total amount of cyanide present, yet with concentrated solutions this does not hold, as cited by Comey. A strong cyanide solution saturated with silver sulphide will yield a deposit of this salt on dilution with water, and such a precipitate can be successively formed and dissolved by alternate additions of water and concentrated cyanide solution.

A study of the molecular weights involved in equation (1) shows that the silver requires nearly its own weight of sodium cyanide to dissolve it, so that the consumption from this cause alone with 500 gm. silver ore would be nearly a pound of sodium cyanide a ton. This feature, as one of the sources of high cyanide consumption experienced with silver ore, renders the field for cyanide regeneration processes a good deal more promising than with banket gold ore, where the total cyanide consumption need not necessarily exceed a very few ounces per ton. Apart from reactions taking place in the presence of lead salts, the absorption of oxygen in reactions (*a*) and (*b*) is considerable; in fact, even in the stage of (2) it amounts to one-seventh of the weight of the silver dissolved. Hence, under these conditions, although oxygen does not play the direct part in dissolving the silver that it does in gold ore treatment, yet its importance in permitting solution to proceed, and the present necessity for the tedious process of repeated agitation and aeration, appear evident. On like grounds experiments by agitating silver sulphide and cyanide solution with the oxidizer barium dioxide, or with air under 100-lb. pressure showed considerable more silver dissolved in a given time than in the absence of either. To illustrate the fact that introduction of sodium sulphide does not cause precipitation of silver when sufficient dissolved lead is present, the following table is of interest, since from this it follows that the presence of dissolved lead allows solution of silver sulphide to proceed, as in equations (1), (5), and (6).

A solution of lead plumbite containing 1.95% PbO was prepared by dissolving precipitated lead hydrate in caustic soda solution. Six argentiferous sodium cyanide solutions, of the strengths stated were also prepared, and to each was added the stated amount of lead as plumbite. Then to each was added sufficient sodium sulphide in solution to combine with all the dissolved silver present. The flasks containing the solutions were then closed and agitated for an hour, after which the solutions were filtered and the precipitate assayed for silver. The results are as shown at the head of the next column.

The trivial amounts of silver in the precipitate show how effectual the presence of lead is in preventing precipitation of silver, and consequently in

TABLE B.

Free cyanide (as KCy) %	Silver present mg. per litre.	PbO added as plumbite mg. per litre.	Na_2S added mg. per litre.	Mg. silver precipitated per litre.
0.50	490	2,600	177	3.37
0.40	392	2,080	141	1.73
0.30	294	1,560	106	2.00
0.20	196	1,040	71	2.30
0.10	98	520	35	0.90
0.05	49	260	18	0.37

permitting the dissolving of silver sulphide to proceed in spite of the concurrent formation of soluble sulphide. To confirm this latter deduction, the first and last experiments of Table B were carried out again on similar lines, but in this instance the sulphide was added before the plumbite. Only trifling amounts of silver were found in the precipitate.

Mercury salts probably act in a similar way to lead salts in forming an insoluble sulphide, though they are but little used on account of their higher cost. Possibly also direct replacement of mercury in the double alkaline cyanide by silver takes place, as claimed by Keith and Hood. It is claimed that only mercury in the mercurous state assists in the dissolution of the silver, so that use of calomel should be preferable to that of mercuric chloride. To account for the dissolving of metallic silver and silver chloride, the following simple equations may serve:

$$Ag_2 + 4NaCy + O = 2NaAgCy_2 + Na_2O \quad (7)$$
$$AgCl + 2NaCy = NaAgCy_2 + NaCl \quad (8)$$

In order to determine how far results in practice are affected by chemical reactions, and how far by the mechanical factor of fineness of crushing of the silicious matrix, it may be of interest to recall a method of examining cyanide residues for encased values. In examining residues of silver ore, boiling in strong nitric acid might be employed, followed, after washing, by agitation with strong cyanide solution and barium dioxide. Boiling in aqua regia in the first instance might tend to produce insoluble silver chloride, whereas nitric acid would form soluble silver nitrate, and after its removal any exposed gold would be dissolved by cyanide as above, or aqua regia might then be used for the second stage.

In conclusion, I trust that this brief and imperfect account of some metallurgical conditions and problems in the largest silver producing country in the world will be considered as a timely variant from our ever present problems of gold ore treatment. If the publication of this paper should serve to elicit further information from those engaged in treating silver ores, or from those interested in the subject from its scientific aspect, the writer's object will have been attained.

I desire to express my indebtedness to A. McA. Johnston and F. W. Watson for carrying out at the Consolidated Goldfields laboratory the experimental work quoted in the paper.

Cryolite is only known to occur in commercial quantities at Ivigtut, in South Greenland. It is used for the manufacture of sodium salts, of special kinds of porcelain and glass, and as a solvent in the electrolytic aluminum process. Calcium fluoride is a by-product in the process of making sodium salts, and this is used as a flux in open-hearth steel furnaces.

STOCK COMPANIES AND COMPANY PROMOTION.

By Henry A. Butters.

*Webster gives the definition of stock company as: "An incorporated company the capital of which is represented by marketable shares having a certain equal par value." Accordingly, the shares relate to the capital of a company and are what is commonly called the stock. The capital of a company may be divided into common and preferred stock, the latter being of several varieties, bonds and debentures. These are all comprised under the generic term, securities, and bear no fixed relation to the actual cash capital. There may be stock without bonds or debentures, but there can be none of the latter without the former.

When a company is described as having one million dollars in capital stock, it means that it has a certain number of shares each having an equal, arbitrary, nominated, par value, the total of which is one million dollars; the par value of each share may be anything from one dollar up. In railway and industrial shares, par is usually one hundred dollars. Such a company may not have one dollar in cash, in fact, would not, until some of its securities had been converted into cash. Then it would have only as much cash as had been realized by such conversion, the amount bearing no fixed relation to the par value of the securities. One half, or five hundred thousand dollars, of the total million in stock, might have been sold for twenty-five thousand dollars, in which event, while the nominal capital of the company would be one million, its actual available cash would be twenty-five thousand dollars. The amount of the capital stock may be purely arbitrary, but should be proportional to the value of the undertaking or business to which it relates. Although companies are formed with the capital stock divided into a given number of shares, each having a nominated par value, in point of fact the organization would be just as effectual if a company should be formed having a given number of shares without any expressed value. If one owns ten shares in a company having one thousand shares, then one owns an integral part of the concern amounting to ten one-thousandths, or one per cent; and that is the essence of the relation of shares to capital. The fact that stock is usually expressed in terms of monetary value is because in theory there is supposed to be a fixed relation between the value of the stock and the undertaking it stands for; there is, however, often a departure from that theory in general practice.

Incorporation furnishes the best known method for enabling a number of individual units of capital to combine to form a large aggregate, the total of which would be more than individuals could command, or might wish to put into a single enterprise. It gives each individual interested a share or ownership which is definitely expressed, and on which he can deal with third parties independently of the other owners or stockholders, and enables the majority to manage the undertaking. Most of the objectionable features of the co-partnership are eliminated in a corporation. Its affairs are governed by a board of directors; and the death, or embarrassment of any individual member does not hamper its operation. To illustrate, suppose that a number of persons wished to contribute a certain sum for the purpose of establishing a fund for engaging in mining or any other business. They form a co-partnership, and so long as all live, and maintain integrity, everything may go satisfactorily. But suppose one of the co-partners should die; then his executor steps in, and the interests of the deceased come under the direction of the court. The situation thus created is fraught with unpleasant potentialities. The court may order the liquidation of the deceased partner's interest; he may appoint some disagreeable person to represent the interest; he may decide that a particular policy is not for the welfare of the heirs. The surviving members of the firm are thus likely to be subjected to serious annoyance, if not to actual losses. Then, too, if one of the partners speculates or gambles, or for any other reason becomes demoralized, it is in his power to incur obligations in the firm's name and use the proceeds for his own ends to such an extent as to involve the concern and often to cause its ruin. In the same case, if each contributes money and all form a corporation, then the individual interest is represented in shares of the capital stock, and the undesirable features of the co-partnership are entirely eliminated. The affairs of the company would be conducted by a board of directors, chosen by the majority of shares, each share having one vote; and in case of the death of any individual, neither executor nor court would have jurisdiction further than to control the voting power of the shares of the deceased member; and the corporation would continue its enterprise unhampered. If the deceased member had been a director or an official, the surviving members of the board would select his successor to serve until the next regular annual election.

The capital stock of a company always serves as a means of apportioning interest, but not always as a measure of value. For example, suppose a mine in which, let us say, there is a net value of ore reserves of $500,000. The mine is purchased on a basis of $^3/_4$ its net reserve, that ore reserve being arrived at in the following manner: We will suppose a million gross in sight. A working plant is required, to cost $250,000, and the cost of mining and reducing the ore would be $250,000. This would leave a net product of a half million, plus the plant, which, unless the ore continued in sufficient quantity to make its operation profitable, would become a negligible quantity and should not be taken into account. In order to go to the public for money, the basis of capitalization would be about as follows:

Price of mine - - - - -	$350,000
Plant - - - - - - - -	250,000
Working capital, cash - -	50,000
Total - - - - - -	$650,000

A fair capitalization of such a proposition would be one million two hundred thousand shares, out of

* A synopsis of two lectures delivered to the Seniors of the School of Mines, University of California. By courtesy of the author.

which there would be sold to the public one million shares at 65% of par, to produce $650,000. The promoter would take a commission of one hundred thousand dollars worth of stock for his own profit, and leave in the treasury the remaining one hundred thousand as a reserve, to be drawn upon for future needs. In such a case the promoter's one hundred thousand in stock would represent accurately the apportionment of his interest, but the term one hundred thousand dollars would not express accurately the value of his interest, because at the moment its value would be only its proportion of six hundred and fifty thousand dollars, the total amount of cash involved. If future operations, however, should disclose another extensive body of ore it might be worth much more than its par value of $100,000. And now just a little explanation as to why the capital has been estimated at a million, the selling price of stock at 65%, and the commission at $100,000. In dealing with commercial, industrial, railway, and kindred enterprises, there are usually tangible bases for computing not only legitimate earnings for, but also amortization of, all securities. In mining, the situation is generally the reverse, and this is the case in the illustration under discussion. There is an element of risk to be reckoned with, and the investor must have a larger margin for possible profit to compensate therefor. Accordingly, the shares are sold at 65 instead of at par; the inference being that if the ore should continue as expected beyond the visible supply, and other probable orebodies be encountered, the value of the stock would increase to par. Manifestly, as the stock is to be sold at 65, there must be a sufficient amount to realize the requirements at 65, and also to provide the two amounts of one hundred thousand each for the promoter and the surplus. All of which can be accomplished only by making the amount $1,200,000. The amount of commission, namely, one hundred thousand to the promoter, would be only a fair profit on such a transaction. He would be entitled to as much more as he could get. The surplus in treasury stock is safe because the mine being dealt with is on a paying basis with large orebodies exposed.

In the search for a good mine, many prospects will be brought to your attention. They may be acquired by original location, or offered by others in the field before you. While it is an axiom that "gold is where you find it," for the novice it is much the safer course to apply himself to geological formations exhibiting the known characteristics which denote the existence of orebodies. It may be taken for granted, therefore, that he will not waste time on any other prospect. Having acquired the prospect in a zone possessing the proper earmarks of mineralization, let us discuss the method of procedure to enlist capital. Always bear in mind that capital is greedy. It is likewise generally timid. Dealing with a capitalist is much like doing business with a lawyer. Your own lawyer draws up a contract as favorable to you as possible, and the other lawyer tries to make it unfavorable to you and favorable to his client's interests. The capitalist working out your proposition will only consider his own advantage in the matter, giving no thought to you. Therefore your own cut-and-dried proposition is likely to be better for *you*. His mind is thereby fixed upon your picture instead of leaving him to make one of his own. Again, a clear, well-defined, written proposition, properly presented, will often engage his attention when a verbal, general haphazard talk will not make the least impression. The capitalist is usually a man of affairs; and such men are usually busy, and have neither the time nor the inclination to do your thinking for you. Many men with good propositions fail of success because they do not make a good presentation. The initial presentation, then, is of prime importance. It should include a general description, giving geographical position, geological conditions, description of workings if any, and what they contain and reveal, all brief and concise. Also reasons for presuming that paying ore may be found, such as contiguity of profitable mines, reasons for analogy, and above all, actual value already proved, as well as physical advantages for practical mining and reduction, such as timber, water-power, and transportation. Following this would come a statement of the amount of money required, which should include a surplus beyond visible needs; then the basis of capitalization; in other words, the amount of capital stock proposed for the company; what portion of it is to be offered for the cash required, and how that cash is to be supplied, and on what dates.

In estimating the amount of capital required, remember that in planning underground work one is dealing with an unknown quantity to a certain extent. Water may be encountered; broken ground, slips, quicksands, etc., all of which may cause abnormal expense; and provision for these is what is meant by a surplus beyond visible needs. There is nothing more irritating to a capitalist than a deficiency in an estimate. It is always embarrassing to the engineer and tends to undermine the confidence of his associates. It is not usually difficult to have estimates accepted at the beginning to cover all reasonable contingencies; so make the fight then, fairly and consistently, for if you do not, but permit your estimates to be cut to such an extent that the company eventually runs short of money, the capitalist will not infrequently require a concession from the original terms. This involves a sacrifice on the part of the promoter, and may put him in such a pinch as to enable the capitalist to dictate his own terms for future contributions. Hence the necessity for liberal estimates of cost, which is the first item in considering capitalization. The second item is the interest of the capitalist. The third relates to the interest which the promoter is to retain for himself. If the promoter does not own the prospect, there would be a fourth item, namely, the consideration which the owner is to receive. The estimates of cost and the price of the property will be fixed sums. The interests of the capitalist and the promoter will be first adjusted on the basis of percentage. For illustration we will assume the price of the prospect

to be $5000; the engineer's estimate for carrying the development up to an agreed stage, $10,000; estimate for unforeseen contingencies, $5000; the interest of the capitalist twice as much as that of the promoter and sufficient for him to remain in control.

When trying to interest capital, do not think to hold control of the enterprise. When a capitalist puts money into a venture, he expects and demands the controlling authority in matters of policy, the composition of directorates, etc. If you insist on managing the whole affair yourself, you will be unable to enlist assistance from capital. What you ought to do is to work into a partnership with your capitalist, with the certainty that if you make good in working for your joint interests, your abilities are bound to be recognized; while if you are unable to handle the enterprise in a satisfactory manner, the capitalist will and ought to insist that a competent man be put in charge to avoid wrecking the entire enterprise.

To begin with, you want in cash, on this basis, $20,000. Here is a basis for the company:

Capital stock - - - - - - -		$100,000
Stock to capitalist for contribution of $20,000 - - -	$50,000	
Promoter's share, half of this	25,000	
Treasury stock - - - -	25,000	

This remaining $25,000 of treasury stock will be found useful in case expenditures exceed original estimates; and if operations be successful it can be sold at a greatly enhanced price for further development. And here arises the question, what is the value of any interest, for example, the promoter's? Although it is evidenced in $25,000 of the capital stock, intrinsically it cannot be expressed at all. Its money value must remain to be created by the results, but its value in proportion to the capital stock of the company and the other interests, is at once and for all time determined.

The capital of a stock company, as has been stated, may be sub-divided into common stock, preferred stock, bonds, and debentures. All these are commonly termed securities. Another security often issued by a corporation, is called a collateral note, which is not, however, an integral part of the so-called capital, but supplementary thereto.

Preferred stock may be stock having preference as to the assets of the company, or preference as to dividends, or both. The preference as to dividends may be ordinary, fixed, cumulative, or non-cumulative. If preferred stock has preference as to dividends and preference as to assets, then the dividend on the preferred stock must be paid before there can be any distribution for the account of the common stock, and in case of liquidation, which means winding up the affairs of the company, the preferred stock would be liquidated before the common stock. Liquidating the stock means reimbursing the owner thereof, in so far as there may remain any assets after settlement of the company's obligations. Sometimes it happens that preferred stock is issued under the condition that it shall be liquidated at a small premium of five or ten per cent, in which event the preferred stock must receive that before the common stock is considered. The participation of preferred stock in the profits of an undertaking may be limited to a fixed percentage, in which event all further profits would be enjoyed by the owners of the common stock. This would be designated as fixed or non-participating preferred. Or, it may be preferred to a certain percentage, after which, the common stock having received a like amount, both classes of stock would divide any remaining surplus equally. This would be 'participating preferred.' For instance, a company having $100,000 in common stock and $100,000 in preferred 5% stock earns for distribution 4% of the entire amount, which equals $8000. In that case a dividend of 5% would first be paid on the preferred stock, requiring $5000, leaving the remaining $3000 for distribution on the common stock, equal to a dividend of 3%. Now, suppose that instead of producing a profit of $8000, it produces a profit of $18,000. This would allow a dividend of 5% on the preferred stock, requiring $5000, leaving a balance of $13,000. This would allow a dividend of 5% on the common stock, leaving the balance, $8,000 to be divided equally between the common and the preferred stock. This would amount to $4000, or 4% additional, on common and preferred stock. In this case, both common and preferred stock would receive a dividend of $9000, or 9%. Finally, if the profit were only $5000 or less, the whole of it would go to the preferred stock. When preferred stock is described as cumulative it means that if the requisite preferred dividend is not paid in any given year, the unpaid dividend stands as an accrued charge against the earnings. It must be paid in some future year, together with all subsequent accruing dividends, before the common stock can receive anything. A case in hand would be that of a company with 5% preferred stock having had two lean years yielding no profits for distribution, followed by a fruitful year with large earnings. The preferred stock would then be entitled to dividends on the two lean years, and also on the fruitful one, before the common stock would receive anything; which explains the term cumulative. Preferred stock may have conditions permitting exchange for common stock within a fixed time. It often happens that the dividends on the fixed preferred stock may absorb the entire earnings of the company for a few years, and afterward the earnings may increase sufficiently so that the dividends on the common stock may be more than those on the fixed preferred, in which event the common stock would be the most desirable; and holders of the fixed preferred would then relinquish it in exchange for common stock.

Obviously the only reason why a company should issue preferred stock would be to give the holders thereof a prior claim upon the earnings of assets of the company as an inducement for investment. This frequently conceals what is known as a 'joker.' Sometimes a shrewd promoter knows that while the earnings of his company may be small in the begin-

ning, they will increase enormously in the future. He issues preferred stock at a liberal fixed rate, say six or seven per cent, with the avowed purpose of giving the investors preference, knowing that ultimately the earnings will be sufficient to pay more than that rate to the common stock, which he holds himself. In that event, while the investor is preferred in theory, in practice he is not.

In taking up an enterprise, the capitalist or syndicate will frequently insist that the money contributed shall receive a fixed rate of dividend before the promoter receives anything. Such a case is met by the issuance of preferred stock. It often happens in large companies that the amount of preferred stock is so great as to make it perfectly apparent that it will absorb all earnings that may be expected for years, and yet the same company may have out a large amount of common stock. A layman could neither see the use or value of that common stock; however, as every share carries a vote and the preferred stock carries no more, the common stock gives to the party or clique controlling it the power to govern the affairs of the company. In such a case it would have been created for that purpose. Preferred stock is sometimes created with a provision for a sinking fund, which means that a certain fixed sum shall be set aside from earnings at stated intervals, to be ultimately used for the redemption of the stock to which it relates. When that stock is redeemed it bears no further relation either to the dividends or assets of the company, and is cancelled.

Stock subject to no preferential conditions is called common stock, in contradistinction to the preferred; and the stock of all companies is common unless otherwise designated.

A corporation bond is an instrument which is the evidence of a debt secured by a mortgage on all, or a portion of the assets or income of the corporation. Bonds secured by a first mortgage are called first mortgage bonds; if secured by any subsequent mortgage they would rank in succession as second or third mortgage bonds, etc. If secured by income they would be designated income bonds. The bonds of a company are created for a specific indebtedness. Each bond stands for such integral part of that indebtedness as is nominated on its face, and the amount so expressed is the par value of the bond. Their particular function is to divide that indebtedness into small units. Corporation bonds are generally created to provide for indebtedness which is to exist for a long term of years. They are designated according to the term for which they are issued and the rate they bear. A bond bearing 5% interest, due in 40 years, would be termed a 5% 40-year bond. They may be registered, in which event, neither principal nor interest could be collected by other than the registered owner. They are not usually registered, and unregistered bonds are negotiable by any holder, the passing of possession conveying the title.

As bonds are usually created in large issues, in order to facilitate collection, payment, and identification of interest, there are usually coupons attached to the bond representing the amount of each installment of interest and maturing on the date when the interest is due. These coupons are cut off on their due dates and forwarded to the proper place for collection. They are evidence as to whom the interest may be due, and when paid and passed into the hands of the payer, form a receipt for the payment thereof. Being secured by a mortgage on the assets of a company, bonds are a preferential security. There is a large class of persons investing in bonds that would not for a moment consider an investment in stock, as the latter must depend upon the success of an undertaking. Business might fail and stock be worth nothing, and yet the bonds be safe, provided the basis on which they were issued was sound; in other words, provided the assets on which they have preference were of sufficient value. Bonds do not share in the profits of a company, consequently the bondholders do not reap any gain beyond the rate of interest paid, with the exception of a small premium to which a bond may advance if it may be fancied by the public. Bonds are not usually issued by mining companies, because in order that they may sell readily, they must be secured by good, convertible, visible assets sufficient to pay principal and interest, and leave a good margin for contingencies.

A debenture is an instrument like a bond, promising to pay a certain principal sum, together with interest, on stated dates. They have all the physical characteristics of bonds but are not always secured by mortgage. They are a favorite form of security in Europe, but are not much used in the United States.

Collateral notes are promissory notes issued by a corporation, usually in sums falling due at different intervals, and secured by the company's bonds and stock. They generally serve a temporary purpose and sometimes provide for emergencies. At this time, when we are discussing the subject, interest rates are unusually high, and people having money to invest are not tempted by the 5% bonds that are usually issued. A company depending for its money upon the sale of its 5% bonds must resort to some means to pay the investor a higher rate and still give him security, but merely, however, as a temporary measure. The 5% bonds can be sold for 70% of par, which would net the investor about 7% per annum as interest, but in the end the company would be requested to redeem the bonds at par and would thereby lose thirty points; the difference between 70 and par. To meet this case, a company requiring a million in cash would deposit a million and a half of its 5% 40-year bonds with a trustee as security, and issue against that security one million in 7% collateral notes, maturing in two or three years. The public would then have a security paying 7%; the company has provided an expedient to meet the prevailing abnormal rate of interest; and still has not parted with its bonds, which can be sold at par, in normal times, and the collateral notes be paid from the proceeds. While the collateral notes are properly called securities, they are not a portion of the issued capital, and do not in reality increase the company's liability, because they are paid out

as a substitute for such part of the authorized capital as is meantime held in trust against them.

Companies are often created and business launched without the co-operation of outside capitalists. A case in hand applicable to his discussion would be one where four or five persons might wish to join for the purpose of opening up a prospect owned by one of the number. We will suppose that A owns the prospect; B is willing to contribute $1000; C, $500; D, $300; and E, $200. In a case like this, all that is necessary in forming the company is to decide what relation the prospect is to bear to the total capitalization, and to fix an arbitrary sum as the capital stock. We will assume an agreement that this prospect is to rank for one-quarter interest in the issued stock of the undertaking. A basis would then be the following:

Total capital stock - - -	$25,000
Reserved in treasury - -	5,000
Total available - - -	$20,000

A, the owner of the prospect, will have one-quarter of the available stock, leaving $15,000 in stock to be distributed pro rata among B, C, D, and E. The total amount of cash involved is $2000. B pays $1000 or 50% of the amount, C pays $500 or 25%, D pays $300 or 15%, E pays $200 or 10%. For convenience we will assume that the stock is divided into shares of $1 each. Then,

B's portion would be 50% -	7,500 shares
C's portion would be 25% -	3,750 "
D's portion would be 15% -	2,250 "
E's portion would be 10% -	1,500 "
Total - - - - - - -	15,000 "

Here again we have an example showing that the stock of the company is an apportionment of interest but not a measure of value, for while the former is accurately expressed, in this illustration the actual cash value still remains an unknown quantity.

The legal methods for the formation and operation of an incorporated company are clearly prescribed in the statutes of the different States. They are properly within the functions of the attorneys who should be retained for the proper safe-guarding thereof, and barring necessary compliance with the law, are of secondary importance. A company may be formed under the aegis of the most distinguished legal counsel in the world, but without the non-technical requirements for success, it will avail nothing.

In order to make the securities of a company attractive there must not only be intrinsic value as its basis, but also an earning power commensurate with the expressed value of the stock for dividend distribution. Leaving the legal steps under proper supervision, the promoter will be chiefly concerned with the amount and classification of the securities, the provision of proper channels through which they may be subscribed, the selection of directors and the formation of the directing board, and the necessary provision for his own compensation or profit. The selection of directors and the formation of the board is most important because into their hands the promotor must entrust his enterprise. It requires a rare kind of a man to become an ideal director, and he should be able to qualify as to five requirements, namely, he should be familiar with corporate affairs; he should be a man in whom the public has confidence; he should himself have sufficient confidence in the undertaking to invest his own money in it and induce others to do the same; he should be liberal-minded enough to treat the promoter fairly, regardless of the latter's necessities; and he should be a man of staunch integrity, resourceful, and conscientious in performing his corporate duties. In selecting these directors many things have to be taken into consideration, and usually this is undertaken in conjunction and simultaneously with negotiations for supplying either a portion or all the capital needed.

In company promotion an underwriter is one who insures the furnishing of money. When the statement is made that a certain company or amount of securities has been underwritten, it signifies that either persons, firms, or syndicates have guaranteed to purchase the securities at a stated price. Most large issues reach the investing public through the medium of underwriters, who make a legitimate commission. The commission is legitimate, because they provide immediately for the necessities of the company, enabling its operations to be inaugurated and to proceed unhampered while the underwriters are finding a market for the securities. Usually the directors, or most of them, are found through the underwriters, or the underwriters through the directors, as the two generally bear intimate relations. The promoter, however, should, so far as he can without detriment to the company, endeavor to have men of his own selection for directors.

There are leading spirits in every organization; it is not unusual to see a board practically run by a small minority of its members, whose technical skill, or money power, or aggressiveness, or some other influence, keeps them in the lead. Such men should be sought out by the promoter, after he has clearly planned his own program, and they should be enlisted in the preliminary stages of his negotiations. All details should be arranged by and through them, so that when the full board is finally formed those members who join later may do so on a settled plan, which is accepted without further discussion.

Incorporation furnishes the best known method of enabling units of capital to combine into a large aggregate without the undesirable features of the co-partnership. Although there is a community of interests between the stockholders of a company as there is between the members of a firm, and all share in the business in proportion to their holdings, yet we have seen the advantages the former has over the latter, even when many persons are interested. Capital stock serves as a means of apportioning interests, but not as a measure of value; the par value of each share may be anything to suit convenience. A company may have preferred and common stock, and also bonds, which have preference over both classes of stock. The legal steps in company forma-

tion are defined by statute in each State. The basis of capitalization and personnel of the directorate should be planned by the promoter. He should arrange all preliminaries with a small committee whenever practicable. Capitalists will often invest in a corporation when they would not do so in a copartnership.

In approaching a capitalist, remember that he is generally greedy, timid, and usually busy; therefore make your presentation in such a way as to cover all those points. The promoter's position should be surrounded with all possible safe-guards and his proposition should be concise, convincing, methodical, and definite. Don't leave the capitalist to think out your basis for you. Your own thinking apparatus is better for you than his. Always estimate on a liberal basis for cost and a conservative basis for earnings. In seeking large amounts of capital try to arrange in the beginning either with one or more individuals or firms to underwrite all that may be needed.

We have discussed within very narrow limits the subject of company promotion and suggested certain bases. In practice the methods of proceedure will not differ materially, but the basis for each transaction must be adapted to the case in hand. When you leave these college halls and go out into the world you have a clear field. There are as yet no professional mistakes to explain, no financial failings to condone. At that moment the public is your patron, the wide, wide world your field; and while every success increases your influence in that field, each failure diminishes your clientele and circumscribes the limits of your horizon. The greater the intelligence possessed on all subjects relating to your business, the greater will be your earning power; hence this address. One may be a successful company promoter without any conception of mining engineering or other technical subjects, but the most successful mining engineers have been those who have had a broad conception of corporation affairs in their bearing upon the acquisition of property for company flotation, and its relation as a basic item to the capital stock of the company, having in mind the cost of acquisition, the cost of development, and the probable return; because those men not only made technical reports, but have been able to recommend to their clients practical bases for presentation to the public. So, while you can win a diploma here upon your technical showing, which will give you ample warrant to advise your clients what to put money into, and what not, you will not have reached the zenith of your earning power until you can likewise show your client how to get his money out again at a profit. And the quickest way is always to form a company, on such lines that the public will buy the stock at a profit.

Electrical air filtration is suggested by an English experimenter, who has discovered that a body positively electrified to 100 volts or over will, if placed in a sooty atmosphere, become covered with soot in a day, while a negatively charged body remains comparatively clean.

THE CARAT WEIGHT.

By E. J. VALLENTINE.

*The use of the carat weight by dealers in gold and precious stones extends over a considerable period of the world's history. According to Dr. Ure, carat was the name of a red bean which grew in the district of Shangallas, in Africa, at one time a famous mart for gold dust. As these beans were remarkably uniform, both in size and in weight, they were adopted by the traders as a standard; they were transported to the East and used in the weighing of precious stones. Morion, however, states that it is derived from the Arabic, *kirat*, signifying weight, and thinks this may again be derived from the Greek *keration*, a small weight. According to Anania de Schiraz, a Syrian authority of the sixth century, the carat or diamond weight was originally taken as the $^1/_{144}$th part of an ounce (*uncia*), twelve of such ounce constituting a mina. The mina, which was derived from the lessor or silver Alexandrian talent, was adopted by the Romans during their occupation of Egypt. As it weighed 5460 gr., the weight of the original diamond carat was, therefore, 3.15972 gr., or only 0.0086 gr. less than that of the present British diamond carat.

A carat gold weight was used in England until recently. It was a unit in a now obsolete system of weights known as 'refiner's weight.' This system, which was used in reporting gold assays, was as follows:

12 oz. = 24 carats.	1 gr. = 4 quarters.
1 carat = 4 gr.	½ gr. = 15 gr. troy.

Until 1882 these weights were used at the Royal Mint in reporting gold assays, 1 carat-lb. being taken as equal to 24 carats of 5760 gr. troy. The amount of pure gold contained in a carat-pound of bullion was expressed in carats; for instance, 22 carat gold (the 'standard' gold from which our gold currency is coined) contains 22 parts of pure gold to two parts of alloy. Although the carat weight is now obsolete, this system is still used by goldsmiths in stating the fineness of the gold of which their wares are made. It has, however, been discarded by assayers and metallurgists in favor of the millesimal system, in which pure gold is taken as having a fineness of 1000. On this latter system, 22 carat, or 'standard,' gold is therefore $^{22}/_{24}$ of 1000 = 916.6 fine.

The carat used in weighing precious stones is a much smaller weight than the obsolete gold carat. It is generally known as the diamond carat.

The diamond carat of 3.1683 gr. is equal to 205.3022 mg. The following sub-divisions are used by diamond merchants: ½, ¼, ⅛, $^1/_{16}$, $^1/_{32}$, $^1/_{64}$, the sixty-fourth part of a diamond carat being known as a 'part.'

Diamonds are usually found in placer deposits, except in the case of the eclogite pipes in South Africa. In Central India and Brazil they occur in conglomerate and gravel, and are associated with a peculiar flexible sandstone, but the matrix of the diamond has not been discovered in either of these deposits.

*Abstracted from Bull. 45, Institution of Mining and Metallurgy.

MINING AND METALLURGICAL SOCIETY.

Constitution and By-Laws adopted at meeting held in New York on April 20, 1908.

Constitution.

1. The name of the association shall be Mining and Metallurgical Society of America.

2. The association shall have for its objects the conservation of mineral resources, the advancement of mining and metallurgical industries, the better protection of mine investors and mine workers, the increase of scientific knowledge, and the encouragement of high professional ideals.

3. The society shall comprise Honorary Members and Members who must be qualified by knowledge, experience, and honorable standing to advance the objects of the association, and shall be proposed for and elected to membership as provided in the by-laws of the society.

4. All interests in the property of the society of persons resigning, or otherwise ceasing to be members, shall vest in the society. No member or officer shall receive salary, compensation, or emolument unless authorized by the by-laws, or by concurring vote of two-thirds of the executive council. Members residing for a year or more beyond the limits of the United States, Canada, and Mexico, shall not be entitled to vote nor hold office during the period of such residence.

5. The affairs of the association subject to the provisions of the constitution and by-laws shall be managed by an executive council of not less than fifteen managers, who shall hold office for the prescribed term or terms, and who shall elect from their own number, a President, not less than four Vice-Presidents, a Secretary, and a Treasurer, who shall hold office for one year, or until the close of the meeting at which their successors in office are elected, and who shall be eligible for re-election. Additional officers may be elected by the executive council from time to time if necessary for the purposes of the association.

6. The annual meeting of the association shall be held on the second Tuesday in January of each year. One-third of the members, present in person or by proxy, shall constitute a quorum for the transaction of business.

7. The association may adopt by-laws, rules, and regulations for the conduct of its business provided that these are in harmony with this constitution, and may provide different methods for amending or repealing such by-laws, rules, and regulations.

8. Amendments to the constitution may be presented at a regular or business meeting of the association; and if endorsed by the council or in writing signed by at least twenty members, a copy of such proposed amendment shall be sent to all entitled to vote, accompanied by comment by the council if it so elects, at least thirty days in advance of a second meeting called for its consideration; at which meeting the amendment may be amended as to wording but not as to intent, and then shall be submitted to a final vote by sealed letter ballot sent to all members; the polls shall be open for sixty days, and for the adoption of the amendment a majority of those entitled to vote shall be required to have been recorded in the affirmative; provided, however, that a negative vote comprising a majority of the votes cast shall defeat the amendment. If the necessary vote for adoption or for rejection is not secured on the first ballot, the council shall order the sending of a second ballot by registered mail to members who have not recorded their vote; and in such case, so many of these second ballots as have been received by members, if not voted within a further period of sixty days, shall be counted as votes cast in the affirmative. The ballots shall be voted, canvassed, and announced as provided in the by-laws.

By-Laws.

1. A candidate for membership shall submit in such form and in such detail as may be prescribed in the rules and regulations of the council a statement of his professional experience. The candidate must have had eight years practical or professional experience, including not less than five years in positions of responsibility, in mining or allied lines of work. Graduates of approved engineering schools shall be credited with one-half the time prescribed for graduation. The candidate must be endorsed by three or more members who shall further certify as to his qualifications for membership in writing. These statements must be based on long or intimate personal knowledge, and shall be submitted in such manner as the council may direct. The candidates must be approved by the council, and elected by sealed letter ballot, sent to all members of the association entitled to vote. Adverse votes, received within sixty days, amounting to five per cent of the votes cast, shall be required to defeat the candidate. A candidate may renew his application a year or more after his rejection.

2. Honorary Members, not to exceed ten in number, must be proposed in writing, setting forth at length the qualifications of the candidate, and signed by at least twenty members of the association. The candidate must be elected by vote of the council, which shall be by sealed letter ballot. One dissenting vote shall defeat such election. Honorary Members are not entitled to vote nor to hold office and shall not be required to pay initiation fees nor annual dues.

3. All elected candidates shall be duly notified and shall subscribe to the constitution and by-laws in such form as the council may direct. This latter provision shall not apply to Honorary Members.

4. There shall be an initiation fee of twenty-five dollars for each new member after the total membership reaches two hundred and fifty.

5. The annual dues shall be ten dollars, payable in advance in January of each year. The council may in its discretion permit any member not in arrears to become a life member on payment of an adequate sum for the purpose based on his expectation of life according to reliable tables of mortality.

6. The membership of any person in the association may be suspended or terminated for reasons of weight by a four-fifths vote of the executive council. Notice of such intended action shall be sent to such

member by registered mail and action shall not be taken for at least thirty days after the receipt of this notice by such member. A member suspended or expelled may demand a sealed letter ballot sustaining the action of the council. This ballot shall be sent to all members entitled to vote and may be accompanied by a statement signed by the council or a committee thereof, and by a statement on behalf of the accused of not more than one thousand words, or not exceeding in length that prepared by or for the council. A majority of the votes received within thirty days shall be required to reverse the action of the council.

7. The executive council shall from time to time divide the territory occupied by the membership into fifteen geographical districts to be designated by numbers. Each of the districts shall be, as nearly as practicable, contiguous territory; each shall contain as nearly as practicable an equal number of members. The council shall announce such division to the association three months before the annual meeting. There shall be at any one time not more than fifteen managers, one from each district, whose term of office shall be so arranged that five of them shall retire each year.

8. Three months before the annual meeting the secretary shall send a nomination ballot to each member of the association in the districts for which new managers must be elected, with the request that he shall nominate three members, in such manner as the council may direct, as candidates for manager to represent his district. Nominations shall be received for twenty days when the polls shall be closed. Sixty days before the annual meeting the secretary shall prepare a ballot, containing in and for each of these districts not less than three names, which shall be in each case those receiving the largest number of nominating votes before the closing of the polls. This ballot shall be mailed to each member entitled to vote, who may vote for one manager in each district, having the right to substitute names not on the list, and to cast not over three votes for a single candidate, provided that the total number of votes cast by such member shall not exceed the total number of vacancies to be filled. The ballot shall be signed, sealed, and voted as prescribed in by-law 15.

9. At noon of the first day of the annual meeting the polls shall be closed and the ballots counted by tellers appointed by the President. Managers shall not be eligible for such appointment. The candidate in each district receiving the largest number of votes shall be elected. In case of a tie the President shall cast the deciding vote.

10. The term of office of a manager shall begin immediately upon election. Vacancies occurring at any time in the council may be filled until the next annual election by a majority vote of the remaining members. At the next annual election new managers shall be elected to fill such vacancies for the unexpired term of office only.

11. The officers of the association, as provided in the constitution, shall be elected at the annual meeting, or whenever a vacancy occurs, by a majority vote of the council. Their term of office shall begin at the close of the meeting at which they are elected. For reasons of weight any office, except that of manager, may be declared vacant by a two-thirds vote of the council. The duties of the several officers shall be such as usually attach to the office or such as may be determined by the council. The council may delegate its powers to persons or committees, and may make such rules and regulations as may be necessary for the proper conduct of the business of the association, provided that these are in harmony with the constitution and by-laws.

12. Meetings of the council for the transaction of business may be called at any time by the President, and shall be called at the request in writing of three managers. Unless for reasons of weight at least ten days' notice of meetings shall be given. Five managers shall constitute a quorum. A letter ballot of the council shall be taken on any question of importance if so ordered by the presiding officer at any meeting, or at the request in writing of three managers.

13. The council shall provide for regular stated meetings of the society for the transaction of business or for the reading or discussion of papers to be held at such times and places as may best serve the interests of the association. Special meetings of the society or of any section thereof, for a definite purpose, may be called by the President, or shall be called, on a request in writing signed by twenty members. It shall not be in order at a special meeting to discuss other business than that stated in the call for the meeting. Except for reasons of weight, at least thirty days' notice shall be given of all meetings. Except at annual meetings ten members present in person or by proxy shall constitute a quorum. Resolutions endorsing or condemning matters of public or professional interest shall take the course prescribed for amendments to the constitution. Other matters of importance, by vote of members present at any meeting, or by direction of the presiding officer, or by vote of the council, may take the same course.

14. Local sections or professional groups of members of the society may be organized for social, scientific, and professional purposes in harmony with the constitution and by-laws, and such sections shall have such powers, and shall act under such rules and regulations as the council may from time to time approve.

15. When sealed letter ballots are required by the constitution or by-laws, the envelope to contain the ballot shall be so designed that it may be signed on the outside by the voter for identification, and may afterward be opened by the tellers so as to preserve the secrecy of the ballot. The endorsement may take the form of a proxy, to be voted by the tellers appointed by the President, or by such other person, not a manager, as the member may designate. The ballots signed and sealed shall be mailed or delivered to the secretary, who shall be responsible for their safe-keeping, and who shall endorse thereon the date and time of receipt and make record of such receipt on a list of members kept for the purpose. Any member shall have the privilege at any time

before the closing of the polls, of substituting another ballot, in which case the original shall be returned to him unopened. After the closing of the polls the ballots, arranged in alphabetical order, with the check list of members above mentioned, shall be delivered by the secretary to tellers appointed by the President. The tellers shall verify the check list, and open and mix thoroughly the votes in such manner as to preserve the secrecy of the ballot. The ballots after being counted by the tellers shall be destroyed, and the report of the tellers shall be the official record of the vote. In case a supplementary ballot shall be ordered for members failing to vote on the first ballot, the members whose votes have been counted shall not be permitted to vote a second time nor to change their original vote. The result of the ballot shall be communicated to the members of the association at such time and in such manner as the council shall determine, and shall be announced by the presiding officer at the next business meeting of the association, and recorded on the minutes.

16. The council shall by a two-fifths vote of its members, and shall upon request in writing of twenty per cent of the members of the Society, make any important question submitted to the membership a vote of confidence. In case such question is decided against the council the members shall resign office, their resignations to take effect on the election of their successors, and a new election of the whole executive council shall be ordered to be conducted as provided in the by-laws. The new council shall by lot divide themselves into three classes to serve until the next annual meeting and for one and two years thereafter respectively.

17. Amendments to the by-laws shall take the course provided for amendments to the constitution, save that when the letter ballot is taken a majority of the votes received within thirty days shall pass or defeat such amendments.

Mount Lyell. The Mt. Lyell Mining & Railway Co. has just installed at its reduction works, Queenstown, Tasmania, two large turbo-blowing engines and these along with the smaller one, which has been in use for a year, will make the finest blowing plant in Australia. The smoke from the smelter has destroyed all vegetation within a radius of eight or ten miles, but since the district is not agricultural the company is not troubled with lawsuits on this account. No doubt the great amount of rain, while it keeps the district clean and healthy, has contributed to intensifying this injury. The climate while wet is equitable, there being no cold weather or snow, it being rare that there has been any ice forming more than 1/8 inch thick. The practice in pyritic smelting at the works is yet advancing, and indeed those responsible for its improvement maintain that its possibilities have not been nearly grasped.

Another record for flight on aeroplanes was recently established by Leon de la Grange, of Paris, who was aloft for 555 seconds. However, his wheels touched the ground at intervals, so that he was above touching distance of the earth for 390 seconds, in which he covered about 21½ miles.

Decisions Relating to Mining.

Specially reported for the MINING AND SCIENTIFIC PRESS.

A mining claim located on the lands of the United States is still a part of the public domain, and although proceedings may have been begun by the owner of the claim for the acquisition of title to the land by patent, still the land itself is not subject to taxation by State authorities.

Elder *v.* Wood, 28 Sup. Ct. Rep. 263, Jan,, '08.

An oil and gas lease gave the lessee the exclusive right to drill for gas, oil, or coal for a specified term, and as much longer as any of these could be found in paying quantities. The consideration of the lease was one dollar and a royalty of eight cents a ton on coal mined, and fifty dollars per annum for the gas produced from each well, and sufficient gas to supply stoves in the lessor's farm-house; but no grounds of forfeiture were stated. In an action to cancel the lease the court decided that the law would construe such lease as if it contained a stipulation expressly written therein to the effect that the lease should be forfeited if the lessee failed within a reasonable time to carry out the purpose of the lease.

Mills *v.* Hart, (Kans.) 94 Pac. 142, Feb., 1908.

Where it appeared that the mine boss in charge of the mine had knowledge of the dangerous condition of the entry to the mine, this was held to constitute notice to the owners.

Smith *v.* Garrison, (Ky.) 108 Southwest. 293, March, '08.

Where the dangerous condition of the entry of a mine was known to the operators of the mine, it was held that a miner who was injured by a fall of rock from the side of an entry, without any notice or knowledge of its dangerous condition, was not required to examine or inspect the entry closely in order to ascertain its condition.

Smith *v.* Garrison, (Ky.) 108 Southwest. 293, March, '08.

A miner was employed to drive an entry in a mine. He was injured while engaged in assisting others to set a prop at a place where the entry had been completed, and where it was the duty of the owner of the mine to protect the roof of the entry; he had received no directions or instructions to set the props or to protect the roof of the entry. But the mine owner had failed to perform his duty in this respect although he had promised to do so. The miner was in the entry at his proper place and performing his work, when the necessity arose to try to protect himself and others against certain slate which was about to fall, and which did fall, between them and the mouth of the entry of the mine. The miners could not know in advance the extent to which the slate would fall, whether it would cut them off from leaving the mine or not, and in addition to this they could not perform their labor and run the cars into and out from the slate which was knocked down from the roof, if this slate was permitted to fall. Under such circumstances the miner was within the scope of his employment; the propping of the roof was a thing necessary to be done for the protection of the miners and of the property of their employer.

Ballon *v.* Potter, (Ky.) 106 Southwest. 1178, Jan., '08.

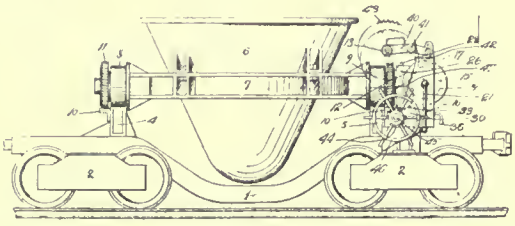
A tenant in common of a mining claim who incurred expenses in prospecting, without the consent of his cotenants, was held not entitled to recover contribution from them. But where one tenant had operated a mine and was sued by his co tenants for an accounting for the profits, the operating tenant was held to have the right to set off as against such non-operating tenants the cost of the necessary improvements, on proof that the improvements were necessary and increased the value of the common property.

Wolfe *v.* Childs, (Colo.) 94 Pac. 292, March, '08.

MINING AND METALLURGICAL PATENTS.

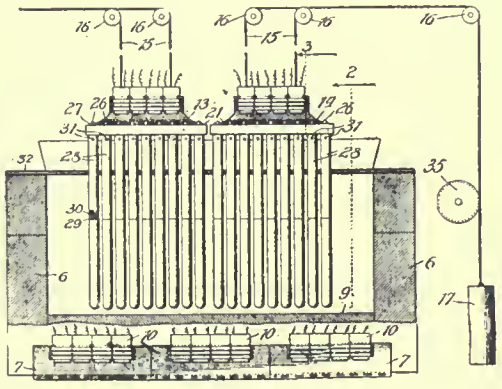
Specially Reported for the MINING AND SCIENTIFIC PRESS.

DUMPING-CAR.—No. 882,129. Munson H. Treadwell, New York, New York.



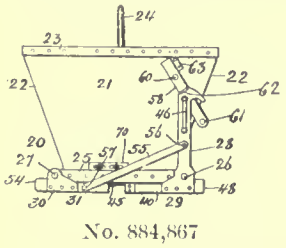
In a dumping-car, the combination with a movable car body, and manual means for moving it to discharging position, of means independent of the manual actuating mechanism for controlling the rate of movement of the car body, substantially as described.

ELECTRIC FURNACE.—No. 881,518. Charles E. Wilson, Ferris, West Virginia.

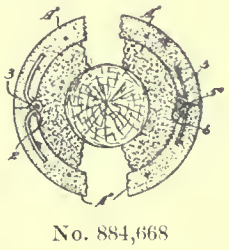


In an electric furnace, the combination of a melting chamber, an electrode in the base of the chamber forming a lower terminal of the electric-current supply, a plurality of suspended and independently adjustable heads above the said chamber independently connected with said supply, and a suspended electrode removably mounted in each of the said heads, the suspended electrodes forming together an upper terminal, in the chamber, of the electric-current supply, whereby the electrode at one head may be renewed while the current passes through the other suspended electrode, for the purpose set forth.

SELF-CLOSING DUMPING-BUCKET.—No. 884,687. Gustavus L. Stuebner, Flushing, New York.



No. 884,867



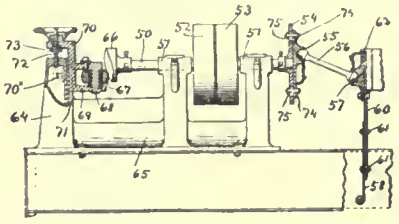
No. 884,668

In a bucket the combination of a body, a swinging bottom fulcrumed thereto, a counter weight on the bottom, a latch arm extending from said bottom, a latch lever fulcrumed to said body in the path of the latch arm, a stop in the path of the upper swinging end of the latch lever to control the amount of downward swing of the lower end thereof, the latch lever and latch arm engaging with each other when the bottom is closed against said body, and tightening against each other with any increase of load in said bucket.

CONCRETE PILE-COVERING.—No. 884,668. Frederick A. Koetitz, San Francisco, California.

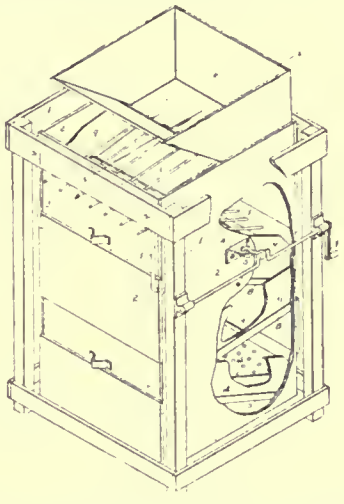
The combination with a pile, of a hollow concrete casing made in segments hinged together along one of their longitudinal edges, and means for detachably securing the opposite edges of said segments.

DRIVE MECHANISM FOR ORE-CONCENTRATORS.—No. 882,512. George E. Woodbury, San Francisco, California.



In a drive-mechanism for an ore-concentrator, the combination with the concentrating table, of a rotatable and longitudinally movable shaft, a head on one end of the shaft, a toggle-bar interposed between said head and the end of the concentrator-table; a cam-faced disk on the opposite end of the rotatable shaft having a gradually increasing elevation of surface from a line of lowest depression both radially and circumferentially to a line of greatest elevation, a roller rotatably mounted and in working-contact with the face of said disk, and a spring adapted to apply its power in opposition to the thrust of the toggle-bar.

APPARATUS FOR SEPARATING GOLD.—No. 883,861. John A. Creasy, Norborne, Missouri.



In an apparatus for separating gold, the combination with a suitable frame of a casing suspended from and within said frame and provided with pan openings at the front and back, means in said casing for supporting pans, and pans adapted to seat on said supports and for insertion into and removal from said casing through said openings, the bottom edges of each of the upper pans being projected partially within the pan next there below substantially as set forth.

ELECTROMETALLURGICAL PROCESS FOR EXTRACTING COPPER FROM ITS ORES.—No. 883,961. Lucien Jaman, Paris, France.

The herein described electrolytic process for obtaining pure copper from its ores, which consists in lixiviating the ores with an ammoniacal solution, precipitating the copper from said solution in the form of a precipitate containing cuprous sulphite, dissolving said cuprous sulphite in an ammoniacal solution, and in subjecting said last solution to electrolytic action in the presence of carbonate of ammonia.

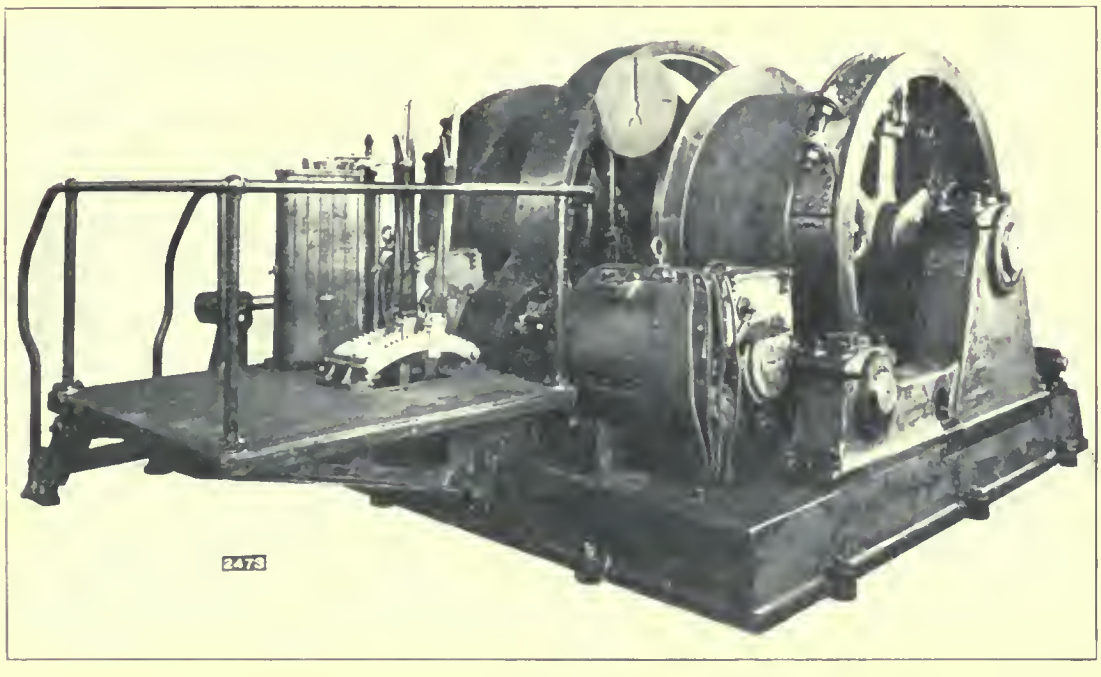
METHOD OF REDUCING LEAD ORES.—No. 882,193. Alfred Francis, St. Louis, Missouri.

The method of treating sulphide ores of lead or concentrates of such ores, which consists in melting ore having fluxes and fuel mixed therewith to produce an approximately pure lead matte, allowing said lead matte to flow onto a bath of molten lead, and blowing air into said bath of molten lead to oxidize the lead and convert the matte into metallic lead; substantially as described.

A NOVEL ELECTRIC HOIST.

The hoist shown in the accompanying illustration was built by the Vulcan Iron Works of Wilkes-Barre, Pennsylvania, for the Hallidie Machinery Co. of Seattle, Washington, for use in the mines of the Carbon Hill Coal Co. It is of the self-contained type, driven by two No. 83 Westinghouse railway-type motors, operating at 550 volts direct current, each motor having a capacity of 110 hp. half-hour rating. The motors are secured to the bed-plate by nose-spring suspension, thereby eliminating the shock occasioned by starting heavy loads. Both motors are mounted on a heavy steel shaft. Between the motors is the main driving pinion, the whole being supported on three babbitt-lined pedestals. The motors are controlled by a type R-6 controller, with separate reverse handle, eight points forward and eight reverse.

Each drum has a capacity for winding 1500 ft. of 1⅛ in. wire rope in three layers, the rope-pull being about 10,000 lb. at 600 ft. per min. At the end of each drum is secured an asbestos-lagged brake-ring, this type of brake being



A Novel Hoist.

able to withstand the heat of heavy braking, outlasting a number of sets of wood lagging. One drum is keyed fast and the other runs loose, on a heavy open-hearth steel shaft. Between the drums is mounted the main spur gear, which, as well as the drum, is split in halves, and planed and secured with turned steel bolts driven in reamed holes. The drum is carried on three babbitt-lined pedestals, which are cast solid with the bearings which support the motor shaft, thereby securing a perfect alignment of gears and shafts at all times. The loose drum is driven by means of a jaw-clutch, which is operated by a hand lever on the motor man's platform. On the platform are also mounted the independent hand-brakes of the band type, each brake being able to to hold the load on any point of a 30° slope. All gearing is made of open-hearth cast steel with machine-cut teeth, and all protected by metal guards as shown on the photographs. The bed-plate is of rectangular box-section, being made up of five pieces secured with turned steel bolts. The connections between pedestals and bed-plate are also made by turned steel bolts and dowel-pins. The hoist is sectionalized throughout so that it may be taken through a tunnel 6 ft. square. This hoist is to be placed in a damp chamber, 16 ft. wide and 18 ft. long, with a maximum head room of 8 ft. It is to be operated continuously, or 24 hr. per day, stopping only long enough to reverse between hoists. The position of the cars in the slope is clearly shown by a positive dial-indicator placed in front of the drums.

COMMERCIAL PARAGRAPHS.

FAIRBANKS, MORSE & Co. have moved into permanent offices in the new building at 162 Second Street, San Francisco.

THE HENDRYX CYANIDE MACHINERY Co., 1738 Broadway, Denver, Colorado, recently shipped a complete cyanide plant to the Old Mexico Mining Co., Oaxaca, Mexico.

MERRALLS MILL Co., manufacturing the mining machinery inventions of W. A. Merralls, with headquarters in Denver, Colo., have moved their general headquarters to San Francisco, where they have opened offices at 140 First Street.

CHALMERS & WILLIAMS, INC., have closed a contract for the erection of a complete stamp-mill and cyanide plant, with tube-mill, rapid cyanide filter, and power plant, for Cia. Minera El Conde y Anexas, Tepehuanes, Durango, Mexico.

THE WESTINGHOUSE ELECTRIC & MFG. Co.'s executive offices, now at 111 Broadway, New York, N. Y., and the New York sales offices and export offices of that company, now at 11 Pine Street, will be removed on Monday, April 20, 1908, to the new City Investing Bdg., 165 Broadway, New York.

W. H. KRITZER, superintendent of construction for the Tracy Engineering Co., is now in southern California, erecting a 20-stamp combination amalgamating and concentrating plant for the Orange Blossom Mining & Milling Company.

THE SMOOTH ON MFG. Co. has issued a leaflet describing Smooth-On gaskets. These are manufactured from a specially prepared mild tough steel, with concentric corrugations, and covered with Smooth-On coating, which expands and contracts like iron.

CARROLL HELMICK will have charge of the Salt Lake City office of The Denver Engineering Works Co., of Denver, at 205 Atlas Block. W. L. G. BIGNELL, who has represented them for some time, will open an office for the same company at El Paso, Texas.

THE HENDRIE & BOLTHOFF MFG. & SUPPLY Co. announces that it carries in stock for immediate delivery all standard makes of motors, transformers, generators, and appliances, in all sizes in ordinary use. Its stock of line materials and supplies is the largest west of Chicago, and it can fill any ordinary order without delay. It specializes in the application of electrical power to all forms of machinery, and can furnish from a stock all sizes of electric hoists, electric pumps, electric driven air-compressors and blowers, as well as small lighting plants.

MINE REPORTS.

OROVILLE DREDGING, LTD., OROVILLE, CALIFORNIA.

The Oroville Dredging, Ltd., made up of the Boston & California Dredging Co., Boston & Oroville Mining Co., Oroville Gold Dredging & Exploration Co., Bear River Mining Co., and the Boston Machine Shop Co., operating 12 dredges, in its report issued on April 8, covering the fiscal year ending July 31, 1907, shows total net receipts, after writing off administrative expenses in Boston and London, and paying 10% for the year in four quarterly dividends of 12½c. per share, leaving a surplus balance of $151,842. The total dredging disbursements have been $415,821, and to arrive at the proper cost of operation applicable to this period, there was added to that figure $9725, being the balance chargeable to dredge No. 1 of the Boston & California Co. for a proportion of a new bucket line installed July 1, 1906. This brings up the total to $425,546, being an average of 5.34c. per cubic yard. The gross bullion output was $895,025, or 11.23c. per cu. yd., and the net product from dredging year it dredged out 14.66 acres, to an average depth of 35½ ft. Its average daily duty was 17 hr. 52 min.; average daily yardage, 2943; and total cost per cubic yard, 3.53c. The gravel dredged averaged 6.36c., leaving a net product of 2.83c. per yard. The highest actual daily average duty was by a Bucyrus dredge, which dug 3148 cu. yd from a depth of 29.9 ft., with daily service of 18 hr. 36 min., and an average cost per cubic yard of 3.64 cents.

OROVILLE DREDGING RESULTS.

Property.	No. dredges.	Ground dredged, cu. yd.	Average depth, ft.	Area dredged, acres.	Returns refined, gold.	Averages. Cents per cubic yard.		
						Yield.	Working expenses.	Net Profit.
Boston and California	3	2,010,937	31.4	39.63	$309,397.22	15.38	6.29	8.09
Boston and Oroville	4	2,529,257	27.0	58.04	247,031.61	9.76	5.49	4.27
Oroville and Exploration	3	2,422,146	31.9	47.07	266,812.43	11.02	3.99	7.03
Bear River	2	1,011,338	36.6	18.54	71,783.66	7.10	6.28	0.82
Totals	12	7,973,678	30.3	163.28	$895,024.92	11.23	5.34	5.89

operations was $469,478, or 5.89c. per cu. yd. Other receipts brought up the total profit to $545,827.

Comparing these figures with the previous year, there appears a reduction in operating cost of 0.73c. per cu. yd., and an increase in yardage dredged of approximately 66.7%. The gross yield has fallen off 3.52c. per cu. yd., but this figure is reduced to 2.65c. per cu. yd. when applied against the greater quantity of material excavated and the decrease in the table submitted herewith.

in operating cost. The dredging operations are summarized

Analysis of the items entering into costs and dredge-duty shows the following average for all dredges employed: Daily dredging-time, 17 hr. 54 min.; average daily yardage, 1932; average depth of ground dredged, 30.3 ft.; material and labor, cost per cubic yard, 1.46c.; electricity, 0.71c.; water, 0.09c.; repairs, 2.44c.; general expense, 0.44c.; taxes and insurance, 0.2c.; total, 5.34c. per cu. yd. The total area dredged was 163.28 acres, with the following average results:

Cubic contents per acre	48,834 cu. yd.
Gross output per acre	$5,481.53
Total operating cost per acre	$2,546.67
Net revenue per acre	$2,934.86

Attention is directed to the relative cost per cubic yard of the old type compared with the more modern dredges, which has led the general manager, W. P. Hammon, to recommend retiring three of the old machines. The average cost per cubic yard of the 12 dredges in operating during the year 1906-07, worked out at 5.34c., whereas, if the employment of three of the old type had been discontinued, the total average cost of the other nine dredges would have been only 4.9c. per cu. yd. Mr. Hammon thinks that even the latter figure can be beaten, together with an increase of output, if two modern dredges be installed in place of the three old ones. The best result obtained was by dredge No. 3 of the Oroville Gold Dredging & Exploration Co., working in hard and difficult ground. This machine has buckets of 7-cu. ft. capacity, and is mounted on a hull 100 ft. long, 40 ft. 8 in. wide, and 8 ft. 2 in. deep. This dredge is one of the Boston Machine Shop Co.'s type, and it has been in service since October 20, 1906. The bucket lips are becoming worn, and will need replacing within a few months. During the

TENNESSEE COPPER, POLK COUNTY, TENNESSEE.

The production for the year ending December 31, 1907, from ore out of the company's mines amounted to 12,599,019 lb. fine copper. In addition to this, 205,133 lb. were produced from custom ore. During the first half of the year 2,230,136 lb. of the copper produced were electrolytically refined, and the remainder was marketed in the form of pig copper. There were recovered in addition 14,905 oz. silver and 85 oz. gold, part of which was derived from custom ore. The cost of electrolytic copper, after allowing for gold and silver, was 12.22c. per lb. The cost of producing and marketing per pound of fine copper in pig was as follows:

	Cents.
Cost at works	10.44
Freight, insurance, and other selling expenses	0.68
Taxes, legal and administration expenses	0.67
Total	11.79

The costs per ton of ore mined and treated, on a total output of 389,603 tons, were:

Ore production	$1.1460
Surface transportation	0.1320
Smelting	1.6210
Engineering and laboratory	0.0620
General expense	0.1700
Converting (13,456,519 lb.), per lb.	0.0074

The profits for the year, after deducting $70,000 for depreciation of plant, were $800,634. Dividends of $1.25 and $2 per share, aggregating $650,000, were paid January 28 and August 15, respectively. An additional dividend of $1.25 per share, amounting to $250,000, was paid out of the profits on February 15, 1908. The sulphuric acid plant was completed in December, 1907, and is now producing acid. No revenue was derived from this source during the year 1907.

MINAS PEDRAZZINI, SONORA, MEXICO.

The Minas Pedrazzini Gold & Silver Mining Co., operating in the Arizpe district, Sonora, Mexico, reports for the year ending January 31, 1908, gross earnings of $442,490, and disbursements amounting to $227,407, leaving a net profit of $215,083. Dividends aggregating $170,416 were paid, and undivided profits amounting to $11,534 were carried forward, besides leaving as a special reserve fund $23,667, in addition to the general reserve fund of $21,508. The total output of bullion was 4876 oz. gold and 656,882 oz. silver, from 927 tons shipping ore and 179 tons concentrate.

During the year the company expended in improvements and additions to the plant the sum of $44,222, and performed a total of 3433 ft. of development work, including 191 ft. of shaft sinking. The manager, E. L. Dufourcq, estimates ore reserves at the end of the year amounting to 8900 tons, valued at $859,000.

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Editorial.

GOOD NEWS comes from Cananea. We learn that there is a prospect of a general resumption, possibly in June. The smelter is being reconstructed on the latest principles. Among the changes to be made is the substitution of bins at the furnaces instead of direct chutes from the conveyor; in other words, the introduction of a moderate storage of mixed charge at the furnace. The Cananea has had bad luck and poor financing; in its early development it was the victim of frontier metallurgy and Wall Street stock-jobbery, but in the capable hands of A. S. Dwight and later of L. D. Ricketts, this enterprise has been re-organized until it promises to be as economically operated as any copper plant in America.

THE PRESENCE of the great white squadron in San Francisco Bay reminds us that the end in view is pacific opportunity for productive labor, not the shout and din of war. These ships are Uncle Sam's policemen, to prevent some boisterous fellow now and then from disturbing the peace and the even flow of commerce. The glory of war is in the peace that follows victory, as the blessing of a mining camp is in the sane and quiet effort to produce for the world's good, after the swashbucklers have been cowed by the representatives of the law. It is the absence of the policeman that invites trouble, and law-breaking, and murder, and the rest. All honor to our patrolmen of the seas! More ships, gentlemen, for the greater certainty of peace and happy industry! We have the metal in our mines with which to build the ships, and the men in our country to man them worthily.

WE NOTE with pleasure that the prize for the best display of ability as a debater in the University of California was won by a student who took as his subject the evil influence of the bad portion of the American press. After referring to questionable advertising, so-called sporting news, and sensational journalism, he took as his chief theme the sale of news-space and editorial columns to persons or corporations willing to pay for the opportunity to influence public opinion. He referred specifically to the San Francisco *Chronicle*, which received $10,000 from the Home Telephone Company, the purpose of this payment being stated by Mr. Mark L. Gerstle, when testifying before the Grand Jury, to have been "to educate the people to the idea of a competitive telephone system. The *Chronicle* was expected, when the matter came up before the board of supervisors, to write it up favorably." This exposure of corrupt journalism hardly caused a flutter in a community so accustomed to bribery of every kind and inured to a daily press that is a daily insult to the intelli-

gence and refinement of this progressive community. We hope that the students of the University of California will not only debate these questions vigorously, but put their sentiment into action, by refusing either to support or to read newspapers that prostitute journalism.

IT GIVES us pleasure to publish the larger part of a lecture delivered by Mr. J. H. Collins. This lecture was addressed to mining students in London and commemorated Clement Le Neve Foster, formerly professor of mining in the Royal School of Mines. Mr. Collins himself has taken a large and useful part in the development of mining education and belongs to the progressive type of Cornishman of the old school. Although a veteran, Mr. Collins is one of those men who keep young in spirit by maintaining a keen interest in the world about them, being always willing to welcome technical improvement and to encourage the younger men responsible for such improvements. He has the proud satisfaction of knowing that his work will be continued by his own sons, for Henry F. Collins, George E. Collins, and Edgar A. Collins do honor to the stock from which they sprang, as did Arthur L. Collins, the eldest son, who died in the discharge of his duty.

White Lead.

BY WAY of celebrating the arrival of the American fleet in the Bay of San Francisco, we publish an article describing the series of technical processes by which the lead ore of the mine is converted into the white paint on the battleship. We take the reader to Idaho and show him the mine from which the lead ore was extracted, and then guide him mentally through the mill in which the ore is concentrated, to the smelter in which it is reduced, to the plant in which it is refined, and finally to the establishment in which the pure metal is converted into white lead ready for shipment to the Navy Yard. Thus the successive steps are described in detail, the effect being to emphasize the multiplicity of methods required to manufacture a single product and at the same time to link the miner and the sailor, demonstrating that the gleaming white paint comes from the dark places of the underworld and owes its existence to the skill of the men of the pick and gad, of the jig and vanner, of the furnace and refinery. No one who cares to contemplate the intricate series of processes involved in the fabrication of this one product will fail to be impressed by the ingenuity of mechanical device and the science of mining and metallurgical practice whereby the end is attained, suggesting the intricacy of the industrial foundation upon which modern civilization is based.

To the details given in the article itself, we may add that the hulls of naval vessels in commission are supposed to be re-painted at least every nine months, and those out of commission once a year. The approximate cost of painting a ship of the *Connecticut* class is $48,000 for labor and $27,000 for material, making $75,000 in all. It will interest our readers to know that a naval vessel of 16,000 tons displacement will carry 12,000 tons of mild, wrought, and cast steel, also 500 tons of cast and wrought iron, also 200 tons of brass and 100 tons of bronze, besides 80 tons of copper. The lead and bearing-metal will weigh 200 tons; the paint and cement, 150 tons; together with 500 tons of ammunition. And all of this is furnished by the miner and the smelter, so that it is not too much to say that the American navy is the product of the American mine.

The photograph of the first-class armored cruiser *California* illustrates home manufacture, for this vessel was built by the Union Iron Works of San Francisco, as was the famous *Oregon*, which made so spectacular a voyage in order to reach the battle-line. As the *California* rides the quiet waters of the Bay of San Francisco, spick and span in her coat of white paint, the men of this Coast can afford to be proud, for she is the product of native industry. Despite her warlike purpose, this graceful vessel is almost feminine in the beauty of her lines, and to this suggestion is added the decorative and preservative touch of paint, enabling her to glory in the sunshine without fear of blemish, unlike the young women of an ancient day, of whom Martial said:

"The chalked Fabulla fears the pouring rain;
Cerused Sabella dreads the blazing sun."

Fabulla's powder might not be storm-proof, nevertheless, the white lead on the fair Sabella's face was not blackened by sunlight, but by sulphur. The men of Martial's time were evidently no chemists, but they had an eye for the beautiful in nature, assisted by art.

Arrival of the Fleet.

NO ONE who watched the stately procession of battleships filing through the Golden Gate can have helped sharing the patriotic pride of the 800,000 people who waved a welcome from the many hills that look upon the haven of San Francisco. Yet there was a curious absence of noise; the bigness of the amphitheatre made the performers seem small and checked the applause of the onlookers. The size of the harbor of San Francisco was never more emphasized than when the American navy made its evolutions without being cramped for room and the whole countryside was lined with sightseers without being crowded. The immensity of the panorama checked applause, the thousands on the hillsides of the City knew that no shout of welcome could reach the sailors on the ships, so they stood silent, absorbed in the spectacle. The first signal was the faint boom of a gun off the Presidio. The smoke of it joined the low-lying fog that had threatened to mar the glory of the day. Soon the guns of Fort Baker on the Marin shore echoed the welcome, and the smoke almost hid the harbor entrance. Then in silent state the leading battleship glided through the Golden Gate, and at exactly equal intervals of four hundred yards the other gray men-of-war followed, each flanked by a dark torpedo-boat destroyer. The whole of the Atlantic fleet, comprising 18 battleships, advanced in single file, the westerly breeze blowing the smoke of their three-fold funnels ahead of them, so that it mingled with the salutes from

land and water, flinging a murk of battle over the peaceful parade. The clouds hung low across the Contra Costa hills and big shadows darkened the water. Suddenly, as the flagship, the *Connecticut*, approached Alcatraz island and swung southward toward the inner harbor, the light broke through the clouds, the sunshine changed the dull gray hull into a radiant white vessel athrob with insistent life and assertive strength. And as the battleships moved into the sunlit space each of them seemed quickened into life and beauty. While the Atlantic fleet was entering the Bay, the Pacific fleet of 9 cruisers had stood at attention off Angel island, and at the proper moment they took their place in the procession, making an evolution the perfection of which even a landsman could admire. They swung into their allotted order, and thus the whole fleet of 18 battleships and 9 cruisers, with the torpedo-boat destroyers, and auxiliary vessels, came round the point into the anchorage that lies off the water-front of the City. Thus was completed a voyage of 14,000 miles which began on December 16, 1907, and ended on May 6, 1908, after a circumnavigation of the two Americas.

As the American fleet lies at anchor its presence here marks an event of manifold significance. To the business man the $200,000,000 of money represented by those floating arsenals is impressive in a financial way, to the townsman the 25,000 men on board represent a faithful body of defenders, to the patriot the feeling of proud possession in men and vessels is overwhelming. But beyond these obvious suggestions, other thoughts will arise to quicken the imagination. The arrival of this fleet punctuates a historic period; the path of empire has come westward at last, and the commercial importance of the Pacific Coast is conceded. Like Balboa, America stands silent on a peak of prophecy and looks across the waves of the Pacific, ready to fulfill her destiny. History moves fast in these later days. It is barely a century and a quarter since the first ship entered the Golden Gate; that was the *San Carlos*, commanded by Juan de Ayala, who passed through the portal of California on August 5, 1775. Likely enough the Spaniards, in exuberance of spirit, fired the old swivel gun on board the *San Carlos* as a salute to the land of destiny. Thus the Mission of Dolores was founded on the sandy peninsula athwart the estuary of the Sacramento river. The mission of the *padres* belongs to an obliterated era, and yet only three lives separate their day from ours; some of the brave Argonauts who built their cabins near the old Spanish settlement and thus founded the modern San Francisco are even yet alive; so soon is history made; we count time not by the slow beat of the pendulum but by the quick throb of brave hearts. While the cities of the old world have scarcely changed and the highways of commerce across the Atlantic have been kept as of old, here within the space of a century and a half the Spanish dominion has been handed to a new people and from the sand hills washed by the Pacific there has risen a city, the expression of a commerce worthy the protection of a great navy. The San Francisco that rose to greet the squadrons of Admiral Evans was a city that has risen more than once. It is barely two years since disaster swept the seven hills of this City and abased a community of half a million people. No one who saw the crowds hurrying out of the lower town in order to get a spot of vantage from which to see the incoming fleet could fail to be reminded of that other exodus in April 1906. Two years ago today the many acres of broken brick and twisted iron lifted an ashen face to the blue of a pitifully perfect sky; today the same site is covered by splendid structures of steel and stone, traversed by orderly streets, and crowded with eager happy faces. So we of San Francisco give thanks for the arrival of this fleet and for much besides, accepting the event as a token of a happier day when San Francisco, guarded by the national navy, shall look as serenely across the interposing seas to the Orient as to the younger East of her Atlantic ancestry.

"The tumult and the shouting dies." Shall we forget? A people that built such a navy and a community that re-built such a city may well be proud of the outward and visible sign of national and civic life. But shall we not hush our plaudits as we remember the mean and corrupt things done in our midst in the name of business. As nearly a million people stood watching the naval parade, was their subdued demeanor without significance? Despite justifiable national pride and personal pleasure in the event, some of them must have been touched with a deeper feeling; perhaps it seemed that the pomp and circumstance of the splendid procession was but a hollow show unless behind it all stood waiting the purified spirit of a patriotism that is unselfish rather than proud, that is willing to sacrifice personal gain to the maintenance of justice, and prepared to surrender the privilege of the one to the welfare of the many. Can a people be great and strong while yet corrupt and greedy? What is the relation of municipal debauchery to national manhood? Can we industrialize our lives without commercializing our souls? Or is it all a mistake, shall we say business is business, patriotism is sentiment, we must keep the two apart; an individual citizen or a community like ours can be undermined by municipal corruption, filthy politics, and strident incivism, and yet be a part of a national aggregate that shall be white as the hulls of the battleships and strong as the armored walls that guard the aggressive guns? The high steel buildings of San Francisco look down proudly upon the white steel ships at anchorage near-by. May either the buildings or the ships be effective in peace or war regardless of whether the men within them are moved by nobility of purpose or mere lust of life? Is patriotism only pride and civism merely self-assertion? Pardon this bombardment of questions; they are pertinent. We are grown men, not children. The irresponsibility of youth no longer becomes a nation that controls the destiny of the Pacific Ocean, and the reckless fun of a boy no longer befits the City that holds the keys of a national commerce. Let us not forget; let us play our part like men.

Personal.

W. P. HAMMON is at New York.

H. R. WAGNER is here from Mexico.

WILBUR E. SANDERS is at Nevada City, California.

CHAS. O'BRIEN is with the Kodiak Mining Co., in Alaska.

C. A. GREEN, of Mill City, Nevada, is on his way to St. Louis.

FRANK J. BOOTH is at the Republica mines, in Chihuahua, Mexico.

ARTHUR FEUST is manager for the Standard Consolidated at Bodie.

EMMET D. BOYLE will be at Hawthorne, Nevada, for several days.

G. F. ZOFFMAN, recently at Palmarejo, Mexico, is in San Francisco.

R. GILMAN BROWN is expected in London, on his return from Chile.

W. C. PATERSON has returned to Denver from Scotland and London.

EDGAR A. COLLINS crossed from New York to Liverpool on the *Baltic*.

W. A. HEYWOOD sailed from Cape Town on April 8, on his return to London.

E. D. LIDSTONE is superintendent of the Big Four lease at Rawhide, Nevada.

CHARLES S. THOMAS, of Colorado, came to San Francisco from Goldfield, Nevada.

JOHN HAYS HAMMOND has returned to New York from Santa Barbara, California.

R. E. TILDEN has gone to Rawhide, Nevada, to establish permanent headquarters.

RICHARD RUSSELL SMITH is engaged in custom assaying work at Stockton, California.

ROBERT ROBERTSON has returned from South Africa and will reside in San Francisco.

R. S. RAINSFORD has resigned from the A. S. & R. Co. and is now at Jackson, California.

W. H. WEED has returned to New York from a lengthy professional journey in Mexico.

C. M. MACNEILL, D. C. JACKLING, and C. W. WHITLEY, of Salt Lake, are here to see the fleet.

LESTER STRAUSS, who resides at Lima, has been examining mines at Cerro de Pasco, in Peru.

WILLIAM H. FREELAND, manager of the Ducktown smelter, in Tennessee, is here for a brief holiday.

LOUIS JANIN, SR., is engaged in mine examinations at Grass Valley and Nevada City, California.

HORACE W. MUSSEN, of Colingwood, Ontario, is visiting the copper districts of Western America.

GEORGE STARR, manager of the Empire mine at Grass Valley, is spending the week in San Francisco.

L. F. S. HOLLAND has come successfully through an operation for appendicitis. He is at Telluride, Colorado.

HERMAN GARLICHS, for nine years in charge of the lead department of the Perth Amboy smelter, has resigned.

G. M. GOUYARD has returned to New York from Mexico, where he has been spending two months on professional work.

J. H. HARTLEY and his brother, Z. B. HARTLEY, have opened an office as mining engineers at San José, in Costa Rica.

BERNARD MACDONALD, of Guanajuato, has gone to New York for a short visit. His headquarters will be at 35 Wall Street.

W. E. THORNE, on his return from Nevada, has gone to examine some dredging ground in Shasta county, California.

EDMUND D. LACHMAN, formerly with Chas. Butters & Co., is now store manager for the Dolores Mines Co., in Chihuahua, Mexico.

S. E. BRETHERTON now has an office in San Francisco, as a consulting engineer. His son, W. B. BRETHERTON, is associated with him.

W. L. COBB has returned to San Francisco from Wyoming, where he has been examining placer properties in behalf of French capitalists.

PERCY A. BABB, general manager for the Mexican Mines Prospects Development Co., has moved the Mexico City offices to Edificio La Cia. Bancaria, Avenida 5 de Mayo.

FREDERICK HELLMANN, lately general manager of the East Rand Proprietary, is here on a visit to his old home. He will shortly open an office at New York, in partnership with THOS. H. LEGGETT.

Latest Market Reports.

LOCAL METAL PRICES—May 7.

Antimony	12@16c	Quicksilver (flask)	$45@45.50
Casting Copper	14¼@15¼c	Spelter	6½@ 7¼c
Pig Lead	4.55@ 5.50c	Tin	32½@34c

METAL PRICES.

By wire from New York.
Averagedaily prices in cents per pound.

Date	Electrolytic Copper	Lead	Spelter	Silver
May 1	12.63	4.08	4.64	52¾
" 2	12.63	4.08	4.64	52⅞
" 3	Sunday.	No market.		
" 4	12.63	4.08	4.64	52⅞
" 5	12.56	4.13	4.64	52½
" 6	12.56	4.18	4.64	52
" 7	12.56	4.20	4.64	52⅜

ANGLO-AMERICAN SHARES.

Cabled from London.

	Apr. 30.	May 7.
	£. s. d.	£. s. d.
Camp Bird	0 14 0	0 14 0
El Oro	1 5 0	1 3 9
Esperanza	1 2 6 ex div.	1 6 6
Dolores	1 6 3	1 5 0
Oroville Dredging	0 11 10½	0 11 6
Stratton's Independence	0 2 9	0 1 6
Tomboy	1 12 6	1 11 3

(By courtesy of W. P. Bonbright & Co., 24 Broad St., New York.)

SOUTHERN NEVADA STOCKS.

San Francisco, May 5.
(Exchange closed—holiday May 6 and 7.)

Atlanta	$ 23	Manhattan Con	11
Belmont	1.17	Midway	45
Columbia Mtn	30	Mizpah Extension	.....
Combination Fraction	65	Mohawk	.....
Daisy	1.30	Montana Tonopah	1.67
Fairview Eagle	.....	Nevada Hills	2 27
Florence	3.75	Rawhide Queen	1.75
Gold Bar (Bullfrog)	15	Red Top	.....
Goldfield Con	5.47	Sandstorm	33
Gold Kewanas	.....	Silver Pick	20
Great Bend	41	St. Ives	31
Jim Butler	30	Tonopah Extension	1.10
Jumbo	.....	Tonopah of Nevada	8.35
Jumbo Extension	30	Tramp Con	18
Laguna	.....	West End	41

(By courtesy of W. C. Ralston, 353 Bush St.)

COPPER SHARES—BOSTON.

	Closing prices. May 7.		Closing prices. May 7.
Adventure	1¾	Michigan	10¼
Ahmeek	70	Mohawk	48½
Allouez	27	Nevada Con	11½
Amalgamated	59⅞	North Butte	58½
Arcadian	3⅜	Old Dominion	35
Atlantic	13⅛	Osceola	.....
Bingham Con	.....	Parrot	20¼
Boston Con	12	Phœnix	.....
Butte Coalition	22½	Quincy	.....
Calumet & Arizona	104	Rhode Island	2¾
Calumet & Hecla	650	Santa Fe	1¾
Centennial	22	Shannon	12
Con. Mercur	40	Superior & Pittsburg	12¼
Copper Range	69¾	Tamarack	58
Daly-West	9	Trinity	.....
Franklin	7¾	United Copper com	6
Granby	90	Utah Copper	29¼
Greene-Cananea, ctf	8	Victoria	2¾
Isle Royale	19¾	Winona	4¾
Mass	2¾	Wolverine	127½

General Mining News.

ARIZONA.

COCHISE COUNTY.

A vein rich in silver has been discovered at the Fink property on Silver creek near Paradise.——The Calumet & Arizona is remodeling its assay office, which is situated at the Oliver shaft.

GILA COUNTY.

The fifth furnace of the Old Dominion smelter was blown in yesterday, and the full battery of furnaces is now running day and night, for the first time since the slump in the copper market. When the slump came the old Dominion shut down two furnaces. Last October was the banner month in the history of the Old Dominion smelter. Four million pounds of copper were turned out, the highest record ever made in the Globe district.——Ore running $554 in gold and silver has been discovered in an abandoned mine 75 miles north of Globe, and has caused a rush of miners into that part of the country.——The Warren-Perneson-Moody Co. has struck an immense body of copper ore at its property on Upper Pinto creek. The company is now driving an adit to strike the vein at about 200 ft., from which point a shaft will be sunk.

MOHAVE COUNTY.

The Gold Bug, in the White hills, 30 miles north of Chloride, is being overhauled, after which the shaft will be sunk several hundred feet deeper.——A. L. Darbyshire has purchased the Abe Lincoln group of claims, five miles south of Kingman, and will at once sink a 200-ft. shaft. ——The new shaft on the Last Chance mine of the Goldroad Red Top Co. is now down 20 ft. and is showing good ore. Work on the property will be continued and the shaft sunk to a depth of 100 ft.——Many of the old stockholders of the Blue Ridge Mining Co. have combined and are to bring suit for the recovery of their interest in what is now known as the Tom Reed mines.

YAVAPAI COUNTY.

(Special Correspondence).—The Hull Copper Co. has about 14 ft. of good copper ore in its adit on the Cleopatra claim. It is a heavy sulphide and is identical with the sulphide ore found in the United Verde properties, which are situated just on the other side of a small mountain from the Hull Copper Co. holdings.——The adit which will drain the workings of the United Verde mine will be completed by Aug. 15. The water, now being pumped, is strongly impregnated with copper, which latter is saved by the usual system of precipitation on scrap-iron in tanks and troughs.——The Verde Grande shaft is now down 600 ft. It has entered a soft formation, making progress much easier, and indications are that an orebody will be encountered soon.——The Jerome Mines Development Co., owning the old Harryhansen property, has completed the installation of machinery and has resumed sinking in its three-compartment shaft.——The Sycamore company has suspended operations in its shaft, owing to an excessive flow of water. The ground will be thoroughly prospected, however, and another shaft will be started at once.

Prescott, May. 1.

CALIFORNIA.

HUMBOLDT COUNTY.

The antimony smelter at Bloody canyon, 14 miles from Mill City, was blown in last week for a trial run, and despite the damp weather and wet fuel was a complete success. The furnace is constructed to burn sagebrush.——The Imlay mine, formerly the Morrison, is shipping ore regularly, and reports some new pay-shoots.

INYO COUNTY.

A syndicate of Indiana men has purchased a two-thirds interest in the Red Rose group, near Bishop, and taken a lease and purchase bond on the Ivanhoe and the Gem group of claims. J. E. Wernecke will have charge of the development of these claims.——The hoisting plant for the Bishop Creek Gold Co. arrived last week and will soon be working. ——Rich specimens of ore were found on the Chicago property. A shaft is being sunk.

NEVADA COUNTY.

(Special Correspondence).—The Brunswick is driving an adit to strike the vein on the 600-ft. level.——The Union Hill vein has been struck in a raise from the 250-ft. level at the Union Hill mine. The vein is 18 in. wide and shows excellent ore. The Greek vein, recently struck, is being developed. Cliff Graham is superintendent.——Work has been resumed at the New York-Grass Valley mine by the Prudential G. M. Co., composed of San Francisco people. The company has raised $54,000 to pay off all indebtedness, with a balance in the treasury to carry on development. No money will be expended for surface improvements until sufficient ore has been developed to warrant such a step. The Prudential is issuing one share of its own stock for 20 of New York-Grass Valley. The property was badly mismanaged under the old board of directors and was soon in financial straits. A. P. Wilson has been appointed superintendent.——The 26-ft. raise from the end of the adit at the Jenny Lind has encountered the channel and disclosed large quantities of rich gravel. Drifts and cross-cuts will be driven to determine the extent and strike of the channel. The mill will be started in a few days.—— Work has commenced on the lead-gold ore vein on the Williams-Ryan-Whiting group of claims, near the Mason ranch. A small pump will be installed to handle the water.——A five-year bond on the Bullion mine has been secured by Samuel Mills of this city. The shaft will be unwatered and sunk 500 ft. deeper. The property has been developed to a depth of 1500 ft., with a fair-grade body of ore at the bottom of the shaft. A 2-ft. vein of ore assaying $14 per ton has been struck near the surface on the W. J. Michell ranch. It is probable that it will be worked by the owner.—— Sinking continues at the Central shaft. Excellent ore is being opened up below the 4000 level.——Good ore is being developed in the lower workings of the Pennsylvania. The mill is running steadily.——The Golden Gate M. Co. has purchased the Alpha mine, an adjoining property, which will be worked through the Golden shaft. W. P. Martin is superintendent.——Extensive development work is going on above the 400 level at the Mountaineer mine. A new hoist was recently installed in the adit 900 ft. from the portal. About 30 men are working.——Development work is going on at the Delhi, with considerable ore blocked out. The old board of directors has been re-elected.——Thomas Mulcahy has located the Mammoth claim in the Birchville district.——Work is being prosecuted with renewed vigor at the Champion mines. James Moore has been succeeded by John Stevens as foreman.——The Murchie shaft is going down steadily. Good ore is coming from the lower levels and developments are under way.——At the Yuba mine, in the Washington district, arrangements are being made to operate the property on an enlarged scale during the summer. A large force of men will be employed.——Work on several of the copper properties in the French Corral district is expected to be resumed at an early date.

Grass Valley, May 7.

PLACER COUNTY.

Nickey & Beers have started work on their Standard Unit property.——Twenty men are at work at the Hidden Treasure.——The Ray & Savage mine on Duncan ridge will start at once driving an adit.——The adit at the Clark mine on Devils canyon will be extended 500 ft. farther, with the hope of striking the Dardanelles channel.——The old Bishop mine, now called the Pacific, has been bonded to Oakland capitalists.——The owners of the Rueblin mine will enlarge their stamp mill this season.——Ed Cavanaugh has sold one-half of his interest in the Black Canyon, one mile and a half above Westville, and work on the adit will be resumed.——Vore and Young have stopped sluicing at the Annie Laurie because of lack of water, and are driving cross-cuts from the head of the adit.——The Long Valley Mines Co. has been incorporated with the purpose of acquiring and working the Hafner quartz mine, on Rush

creek.——The Bonnie placer on Poorman's creek will be worked.

SHASTA COUNTY.

The Colorado, two miles south of Shasta, has been bonded to N. W. Kleyn-Schoorell of Mill Valley, who will proceed at once with development.——The hull of the new suction gold dredge, built at Central Spur, has been launched and the machinery will be put in at once.——Furnace No. 2 at Kennett will be ready to blow in about May 10, after which furnace No. 1 will be given an overhauling.

SIERRA COUNTY.

A rich shoot of ore has been discovered in the Ophir mine at Alleghany.——The Sierra Buttes, one of the oldest quartz mines in California, is being reopened.——A free-gold quartz vein about 16 ft. wide was opened in the Young America at Forest City last week.——Forty men are working at the Bellevue mine, between Gibsonville and La Porte.

TUOLUMNE COUNTY.

A new pipe-line is being put in at the Little Bonanza mine at Sonora, and when it is completed the mine will start again.——The Wild Cat and Joe Hooker properties, at Soulsbyville, are being unwatered, preparatory to working. ——The Gilt Edge placer mine, near Confidence, is working. ——The Arbona, at Tuttletown, mine and mill are running full blast. New machinery has recently been put in.

TRINITY COUNTY.

The Lappin mine has started up again with a force of seven men.——At the Brown Bear mine six leases are being worked, employing 20 men. The mill is running steadily on ore from the different leases.——The Bullychoop is working 30 men, and the mill will start soon. A 1300-ft. gravity tram from adit No. 7 to the mill has been completed.——The Globe mine, near Dedrick, will soon be opened and equipped with new crushing machinery.—— The Nash mine, on Coffee creek, has been leased to Gordon Abrams of San Francisco, who put 30 men at work.——The Golden Jubilee mill will start soon.

COLORADO.

CLEAR CREEK COUNTY.

(Special Correspondence).—The Black Eagle mine on Chicago Mtn. is shipping a heavy tonnage of smelting ore. Recently the 15-ton mill, situated near the base of the mountain, was remodeled, the capacity being increased to 40 tons per day. Only ore carrying less than $12 per ton is being treated, the balance being shipped direct to the smelters in Denver. Operations are being centred on the 4th and 6th levels, where large reserves of mineral are in evidence. An aerial tramway has been constructed from the collar of the shaft to permit of handling the ore at less cost.——The Merry Monarch adit on Fall river is being driven steadily forward, having been advanced 100 ft. The heading is now penetrating the network of veins traversing that district.——A contract has been awarded by E. M. Moscript, owner of the Lone Tree mine in the Lamartine district, for driving the Teller adit to intersect the Lone Tree vein. According to surveys, the objective should be reached within 75 ft.——A. Thoman, leasing on the Gold Dirt, is carrying a stope upon an 18-in. streak of gold-bearing ore. Regular weekly shipments are being made, with average returns of 5.6 oz. gold per ton. Jacobs & Horstman, leasing on the 5th level of the same mine, are breaking 5-oz. gold ore, and in addition a big body of mill dirt is exposed.——Chas. Carlson, leasing on the Lucky Hesperus, Democrat Mtn., is running a drift on a 6-in. streak of 800-oz. silver ore. Stoping is to be started shortly. ——The Butts lease on the Astor is making an excellent showing. A body of quartz mixed with ore is showing in the stope, that is from 2 to 2½ ft. wide, and from recent shipments returns of 250 oz. silver per ton have been received.——The Capital mines are breaking all records, from a production standpoint, in the Georgetown district. During the past week 50 tons of concentrate were marketed that brought $300 per ton in gold, silver, and copper. This mill is now treating 135 tons of ore daily.——The Lorenza mine, on Saxon Mtn., is again undergoing development. The adit is now in 300 ft. and a big body of mineralized quartz is showing which is heavily seamed with stringers of high-grade ore. Green carbonates are showing and assay tests show values of 1000 oz. silver per ton. Albert Santo is the owner.——The Dunkirk, on Sherman Mtn., is being developed by a syndicate of Denver capitalists. A raise is being carried from the Ashby adit level and a body of lead-zinc ore 18 in. to 2 ft. wide is being followed. The product is to receive separation at the Mendota mill.—— The Horseman property, in the Daily district, is being developed. The adit is in 300 ft. From the shaft workings a fair production was made a number of years ago. ——A raise has been started on the Ramsdell, which is destined to connect with the old shaft workings, down to a depth of 70 ft. There is exposed a 4-in. streak of $60 gold and silver bearing ore. From the old workings a production of $25,000 was made a few years ago.——The strike made a few weeks ago on the Ocean Wave tunnel of the Colorado Central is growing richer. The vein measures a full 18 in. wide and the last mill-run brought over 1000 oz. silver per ton. This is the richest block of ground operated in the mine in over 10 years, and a record-breaking production is being made. F. A. Maxwell is the lessee.—— The Mineral Chief mill will be completed by June 1.—— The New Boston mine, on Democrat Mtn., has entered the list of shippers and from this time forward a steady output is promised.——The compressor plants at the Tobin and Wilcox adits were started May 1. As a result the lessees are again at work breaking ore, and shipments will be started next week over the Argentine Central.——Work is to be resumed on the Josephine, West Argentine district. Previous to the close-down for the winter a streak of ore had been encountered in the raise 900 ft. from the adit entrance, that measures from 8 to 12 in. wide, carrying $60 per ton in silver and lead. Shipments will be started at an early date.——The Montgomery-Ward adit, Republican Mtn., is being driven steadily forward. A number of stringers of ore have been encountered, and it is believed that the Pay Rock Extension vein has been reached. From ground in close proximity a production of $3,000,000 was made a number of years ago from the old Pay Rock mine. ——It is reported that work will soon be resumed on the P. T. mine, situated on Chicago Mtn. The water in the shaft workings has been drained by the Quito, and the reserves of medium and low-grade ore can now be handled. Denver capitalists are interested in the enterprise.——The Quito shaft is being sunk by day labor, an average of 4½ ft. per day being made.——An 8-in. streak of solid lead ore has been encountered in the raise being carried from the Teller adit to connect with the Freeland workings. This raise will be completed within a few days, at which time natural ventilation will be afforded.——The St. Louis shaft on the Crown Syndicate holdings, Lamartine district, is to be sunk 400 ft. farther, making the total depth 700 ft. Buildings are to be erected and necessary machinery installed at an early date.

Georgetown, May 5.

LAKE COUNTY.

Operations were started last week on the Louise property, in South Evans gulch. Otto Thurn, who has a lease, expects to sink the shaft 100 ft. deeper and then prospect. It is possible that the present steam plant may be replaced by electricity.——New machinery is being placed in the Canterbury mine, which will soon be worked in connection with the Catawaba and other mines in the Canterbury district.——Sixty tons per day of iron ore are being shipped from the upper levels of the Starr. The shaft is being retimbered and the lower levels will be worked later.——The Anona, on Long and Derry hill, opened last week, working 30 men in three shifts. Since the mine was closed in November electricity has been installed for both power and lighting. The shaft is down 90 ft., from which level the work will be done at present.

OURAY COUNTY.

A good strike was made lately on the Snow Flake, at

Red Mtn. The orebody is a large one, and is in two grades, one averaging $45 and the other $52.——M. T. Chestnut, Jr., has purchased an interest in the Killarney claim.——A vein carrying gold, silver, copper, and lead has been struck in the adit of the Precious Metals property near Chattanooga.

TELLER COUNTY.

The Isabella Co. shipped three cars of low-grade ore from their Bull Hill property last week.——The Calhoun Investment Co. has purchased the Cog Road, Last Shot, and Peak View claims.——James Hoar has leased the Alice property on Raven hill.

The Joe Dandy cyanide mill has been remodeled, and is running again, with double the former force. The shaft on the Joe Dandy is down 500 ft. and laterals have been extended on every level.——The bottom level of the Requa Savage has been connected with the shaft on the Home claim, and as a result the ventilation in the former is much improved.——H. J. Austie has leased the E. Porter Gold King property, on Gold hill, for a term of two years on graded royalties.——King Bros. have taken a sub-lease on the dump of the Abe Lincoln and expect to ship one car per day.——The Wabash Con. M. Co. has purchased the Colorado and the Bear Valley placer claims.

IDAHO.

IDAHO COUNTY.

(Special Correspondence).—Native gold has been struck in a newly opened property in the Clearwater valley, about 14 miles from this place. The gold was found at a depth of 50 ft. by John Howard and John Lackey, who have been working a claim since last fall. Many locations have already been made on top of the snow, and some conservative mining men believe it means an important stimulus to the gold production of this district.——The Sacajawea Exploitation Co. has put some new machinery on the claims formerly known as the Old Montana group, and is preparing for a summer's run. The equipment consists of two giants and a line of 22-in. pipe.

Orogrande, May 1.

(Special Correspondence).—The Buster mine is carrying on development at the 400-ft. level, and preparing to add 10 stamps to its present mill. The mill is running night and day.——The Espy property is being equipped with a five-stamp mill. Several carloads of the ore sent to the Tacoma smelter for treatment have given net returns of $225 per ton after being transported by pack-horse and freight-wagon a distance of 33 miles.——A 10-stamp mill is now running near Newsome, and a dredge has been installed to work the gravel of Newsome creek. As soon as the snow is gone several giants will be put to work washing gravel. ——The Hogan mine is now preparing for a season's run after being shut down two years. The 20-stamp mill is being overhauled and repaired and a crew of 35 men is at work.——The Twin Buttes property is ready for operation with a plant consisting of rolls and crushers instead of stamps.——The Umatilla is putting its 10-stamp mill in readiness for work. The company owning the property is also constructing a power plant on the Clearwater river which is expected to be finished this summer and will cost $100,000.——The Thunder Mountain people have just installed a new 60-hp. boiler, increasing their capacity to 90 hp. A 10-stamp mill is also being operated on the property day and night. Recently a 9-ft. vein was opened up in the lower workings, and tests have shown it to be of unusually high grade.

Elk City, May 4.

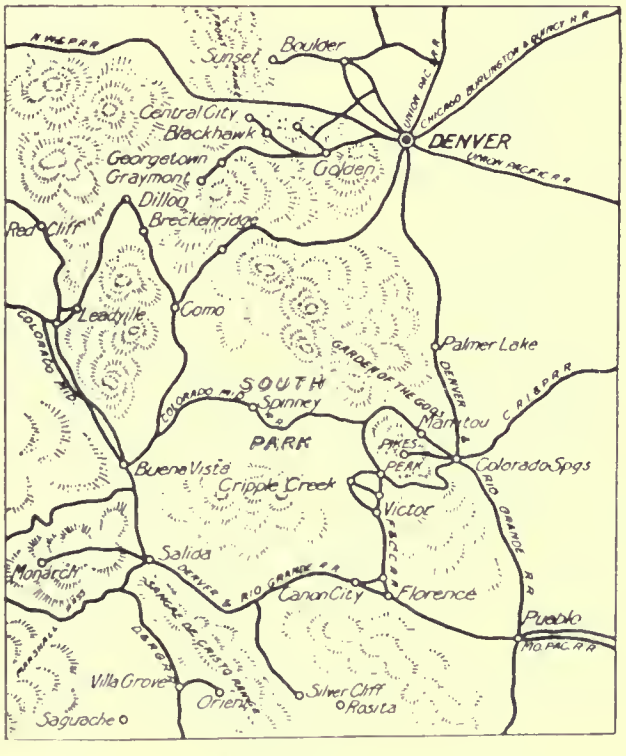
NEZ PERCE COUNTY.

(Special Correspondence).—The Idaho Co. is now operating its 3¼ Risdon dredge here, employing a crew of 12 men. It is the intention of the management to bring over a similar machine from Delta, which was bought and dismantled last year, and install it on the grounds now being worked. Some new land has been purchased during the winter, which, added to that already owned, gives a field that it is estimated will last a dozen years with the two dredges at work. The gravels of this district are very rich in gold, but the Idaho Co. does not disclose any returns.—— The Ozark Mining Co. recently made a valuable strike in a cross-cut in its main adit about 100 ft. from the portal. The ore is free-milling gold. Work, however, is to be pushed on the adit, and no serious attempt to explore the workings will be made until the lode is tapped, several hundred feet ahead of the present face. This adit was begun last winter, and engages two shifts. An 8-drill air-compressor has been installed and is now in use. The property is considered rich, and gives evidence of several small veins intervening between the portal and the main vein.——The Tacoma Business Men's Association has the largest pump ever brought into the Orofino creek workings, and additional machinery is being set up. The association owns extensive deposits of rich gold-bearing gravel.

Pierce, May 1.

OWYHEE COUNTY.

Work has been resumed on the new Potosi mill. The grading is nearly completed, the machinery is all purchased, and mill erection will start this week.——The



A Part of Colorado.

Village Blacksmith reports the discovery of a thin but very rich vein.——The mill at the Banner is nearly completed.

SHOSHONE COUNTY.

(Special Correspondence).—The Success mine has taken a bond on the Monitor mine, situated across the line in Montana, for $150,000. The Monitor has produced about $150,000 of ore during several years of operations. It is opened by a shaft 400 ft. deep and by numerous drifts and raises. According to the terms of the bond, the shaft must be sunk 300 ft. farther, and $60,000 expended in development.——The Rex mill is treating 100 tons of ore daily. Development is also being carried on, and some new machinery is being put into use in sinking to lower levels. ——The Charles Dickens mill, on Moon creek, will soon be running again, the last machinery having been delivered to the site. Last January fire destroyed the plant, and mining operations have been interrupted since to a great degree. The work of development, however, has been carried on, and a cross-cut is now being run in No. 3 tunnel, which is thought to be but a few feet from a large ore-shoot, which will be tapped at a depth of 575 ft. The new plant will have a capacity of 200 tons daily.

Wallace, May 1.

NEVADA.

ESMERALDA COUNTY.

The work of grading for the Rawhide Western, the new railroad from Modoc to Rawhide, was started last week.——The report of a number of rich strikes 18 miles south of Rawhide has caused a rush, and the new camp of Bovard is the result. The surface showings are reported rich in free gold.——A new strike on the Tuett lease, at Rawhide, is reported to be rich in gold and silver.——The Horseshoe, at Goldfield, will resume work at once.——The St. Ives, the Velvet, the Potlatch, and the Gold Horn properties, comprising 117 acres east of the Goldfield Consolidated, have been merged under the name of Goldfield Merger Mines Co., capitalized for $5,000,000. The new company will start at once the sinking of a three-compartment shaft 1000 ft. deep.——The new electric pump at the bottom of the 500-ft. incline shaft on the Kewanas, will be ready for work soon.——The total shipments from Goldfield for the week ending May 2 were 1682 tons, valued at $114,400. The shipments from the Tonopah mines for the week were as follows: Tonopah Mining Co., 2300 tons; Tonopah-Belmont, 580; Montana-Tonopah, 1100; Jim Butler, 240; Midway, 400; West End, 60; MacNamara, 153; Tonopah Extension, 230. Total, 5063 tons.

HUMBOLDT COUNTY.

The Buckhorn and Buckhorn Fraction claims have been sold to N. A. Brown of New York.——Incorporation papers of the Golconda Leasing & Mining Co. have been filed. This company will take over and operate the Butts & Oswald lease on Kraimer hill, two miles south of Golconda. A 25-hp. hoist has been shipped from Salt Lake City and will be installed at once. A shaft has been sunk on the vein to a depth of 75 ft. High-grade ore was sacked at the surface, and from cross-cuts at 30, 60, and 75 ft. Four feet of the vein at 75 ft. assayed $61 per ton, while 18 ft. of the adjacent quartzite assayed $9 per ton. Twenty-two feet of ore has been cross-cut and no walls reached. A 10-stamp mill will be placed on the property within a few months.——The Kindergarten mill, at Seven Troughs, is nearing completion and will begin operations in ten days.——The water has been pumped out of the 100-ft. winze from the lower tunnel of the Mazuma Hills mine and milling ore is being blocked out on three levels. In addition a road is being built to the mill along the hill north of Mazuma.——At the Kindergarten a track is being laid on the 150-ft. level to the Wihuja incline shaft in the Therein property. The Wihuja skip is to be used to elevate the Kindergarten ores to the surface until the Kindergarten working shaft is completed.——The hoisting plant for the Bard & Jess lease has been shipped from Denver. The shaft is now down 165 feet.

LINCOLN COUNTY.

A vein rich in silver has been struck in the Day mine at Jack Rabbit.——The Boston & Pioche has ordered a 100-hp. gasoline engine and compressor, both of which will be used at the Ynba East.——The Ohio-Kentucky will put in new compressors and drills on both the Susan Duster and Prince properties.——The main shaft on the Lucky Dutchman at Crescent is down 325 ft., 850 ft. of drifts are completed, and shipments will soon be resumed.——The Big Tiger will erect a small stamp-mill to handle the accumulation of low-grade ore.——At the Roderick group a shaft is being sunk and heavily timbered in anticipation of deep work.——The Red Star Co. expects to start sinking a shaft on its property at Crescent, and will also probably lease several large blocks of holdings.——The Chief of the Hills claim is now sending ore believed to be high grade, to the Quartette mill.——The Duplex has cut the New Year's Gift vein in the north cross-cut extending from the 500-ft. level of the Fraction claim.——The Goode Hope mine will soon be equipped with a 50-ton mill.

WASHINGTON.

STEVENS COUNTY.

(Special Correspondence).—The Morning-Mammoth Concentrator Co. has just let a contract to the Hallidie Machinery Co. for the erection of a 200-ton concentrator at Metaline, which is to be in operation by October. The plant will cost $50,000. The Morning and Mammoth mines, owned by the same people, are being developed and already have a sufficient quantity of ore in sight to keep the mill going.——The Oriole mine is extending its adit from the 300-ft. station to tap a second vein at 50 ft. distance. In a drift 80 ft. from the adit sulphides of silver were recently discovered.——The concentrator of the Spokane Lead Mines Co. at Metaline is being pushed to completion, and will be ready for ores in May.

Metaline, May 2.

CANADA.

BRITISH COLUMBIA.

The Silver Cup mine, near Revelstoke, made last month the largest shipment of ore in the history of the mine. The ore averages 150 oz. silver, ¾ oz. gold, and 40% lead.——A ton of ore, reported to be worth $18,000, was recently stolen from the Klaskino Mining Co.——Two shifts are now regularly employed at the Gold Drop.——A 10-stamp mill will be erected at the Little Bertha, 16 miles above Grand Forks.——The Granby Con. Co. shipped 264,581 tons of ore from its mines to its smelter during the first three months of 1908, producing 6,600,000 lb. blister copper. During the corresponding period last year 130,483 tons were shipped, producing 3,250,000 lb. blister copper. Last year the company earned $500,000 net during this period, but with the increased output this year the profit was only $150,000.

Following is the tonnage of ore shipments from and crushed at the mines of Rossland for the week ending April 25, and for the year to the same date:

Mine.	Week.	Year.
Centre Star	3,540	56,558
Le Roi	1,295	27,829
Le Roi No. 2	210	9,775
Red Eagle	20	20
Evening Star	....	428
Blue Bird	....	60
California-Giant	....	60
Totals	5,065	94,200

There was received during the past week at the smelter of the Consolidated Co. at Trail 4725 tons of ore. Besides that from the Rossland camp, shipments were received from other mines as follows: First Thought, 145 tons; Snowstorm, 528; Nancy Helen, 31; St. Eugene, 233; Standard, 86; Whitewater, 23; North Star, 139; Millie Mack, 102; Rambler-Cariboo, 102; Ruby, 43; True Fissue, 12 tons.

A switch has been put in at the Homestake for the accommodation of the Blue Bird, and shipments are to be made regularly.——Quayle, Goldsworthy & Jewell have leased the Curlew claim in the south belt for one year and will begin work at once. The Curlew lies immediately south of the Blue Bird.

MEXICO.

It is stated that the Mexican Mines-Prospects Development Co., Ltd., of Mexico City has obtained control of two groups of properties in Jalisco, the San Luis del Oro group of 82 pertenencias in the Hostotipaquillo district, and the Juanquiniquila group of 131 pertenencias situated 30 km. to the southwest of San Marcos. There are several well defined veins from 3 to 8 m. wide in each of the two groups. The San Luis del Oro properties are silver-gold, while the Juanquiniquila are copper-gold, and some shipping ore is now being extracted from this latter group. Both the groups, however, are still in the prospect stage and will be systematically developed.——The Casados mines, in the Hostotipaquillo district, have been unwatered and developed with satisfactory returns. This property is under the control of the Consolidated Mining Co.——The Granadena Mining Co. is constructing an aerial tram from the mill to the Mexican Central railroad station at Santa Barbara, a distance of about 5 km., or a little over three miles. This tram is to have a capacity of 10 tons per hour, and its erection will be pushed with the utmost speed. The mill will resume work in about 60 days, and everything is being put in first-class shape for a big production.

Special Correspondence.

LONDON.

Australian Companies' Reports.—Golden Horseshoe.—Ivanhoe.—Perseverance.—Dry-Crushing and Roasting Gold Ore.

The reports of three of the big Australian companies, the Golden Horseshoe, the Ivanhoe, and the Great Boulder Perseverance, have been issued this week. They afford several subjects for study and discussion, of which perhaps the most interesting is the method of paying for equipment out of revenue, but the information as to costs and management is also of importance. During 1907, the Golden Horseshoe sent 246,775 long tons of ore to the stamps, which caught 38,784 oz. of fine gold. In the sand-treatment plant, 24,716 tons were cyanided and yielded 6535 fine ounces Of slime 208,693 tons produced 56,967 oz., and 13,506 tons of concentrate produced 35,879 oz. In addition, 30,479 tons of old sand and slime, which was re-treated, produced 8528 oz. A parcel of 245 tons of ore was shipped to the smelters, producing 310 oz., as also was cyanide slag containing 775 oz. The total production of gold was 147,680 oz. The total cost per ton, including development, shaft-sinking, and re-treatment of tailing, amounted to £1 5s. 6d., as against £1 8s. 10d. during 1906. The extraction, not counting the re-treatment of tailing, was 86½%, and the average value recovered, £2 10s. 11d. The mine is continuing to open up in a most satisfactory way, and managers, directors, and shareholders have no worries or anxieties. The main shaft is now down to the 1650-ft. level. The ore reserves are figured at 1,062,332 tons, estimated to contain 650,608 fine ounces, sufficient to keep the mill at work for over four years.

The Golden Horseshoe Co. was originally formed in 1894 and commenced to make profits in 1898. The first dividend was paid on Jan. 14, 1899, amounting to £75,000, and the second, third, fourth, and fifth, of equal amounts, were distributed during the same year, bringing the first year's distribution to £375,000. Those were the days of rich ores and bonanzas. Subsequently the mine settled down to economic mining, and the yearly distribution has been between £250,000 and £300,000. For the year 1907 the amount was £255,000, and the total distribution to date £2,520,000. The nominal capital of the company is £1,500,000, having been increased from £300,000 in 1899, by altering the denomination of the shares from £1 to £5. This alteration was made so as to bring the nominal value near the real value, or at least nearer the market quotation. Different counsels ruled in those days of booms, and the policy of keeping down fixed charges was inaugurated later on, when mining was conducted as a more legitimate business. The policy has been not to capitalize equipment, but to make the mine pay for all expenditure. Altogether £440,000 has been spent on plant, and £267,679 on mine development. The whole of this expenditure has been met out of revenue, and the items of mine development and plant machinery and buildings do not appear in the balance sheet. The general manager of the mine is John W. Sutherland, and the company belongs to the 'Kaufman group.'

The second company mentioned, the Ivanhoe, may be called a 'Govett company.' The general manager is R. B. Nicholson, and Bewick, Moreing & Co. are the consulting engineers. The mine adjoins the Golden Horseshoe and the Great Boulder Proprietary, and was floated in 1897 by Whitaker Wright. The capital is £1,000,000 in £5 shares. As in the case of the Horseshoe, the expenditure on development and plant has been charged to revenue. Altogether £740,313 has been spent in this way, and all this has been written off except £54,295, which represents the original working capital in hand when the company was formed. During 1907, the stamps crushed 231,050 short tons, and produced gold valued at £151,143. Of sand 111,514 tons yielded gold worth £82,969, and 99,811 tons of slime produced gold worth £160,379. In addition, 19,725 tons of concentrate yielded £128,078. The total extraction of gold had a value of £522,571. The ore was estimated to be worth £2 12s. 0d. per ton. Of this £2 5s. 3d. was extracted, being at the rate of 87%. The working costs were £206,209, and mine development and plant £47,884. After paying London expenses, etc., a net profit of £261,378 was made, and £240,000 was distributed as dividends. The ore reserves are calculated at 926,737 tons, estimated to contain gold worth £2 12s. 0d. Since the commencement the company has taken out a total of 1,075,559 fine ounces of gold, valued at £4,584,045. The dividends up to the end of 1907 sum up £1,940,000.

The Great Boulder Perseverance reflects even more credit upon its managers than the two companies already referred to, for its position has been retrieved after sinking deep in the mire of mismanagement. Of course most of the West Australian companies were extravagantly managed in their early days, both as regards prodigality of expenditure and careless or willful exhaustion of the best ores. The Perseverance had a very bad fall, and the problem that the new controllers and engineers had to face was a difficult one. The largest share of the credit belongs to Edward Hooper, who took the position of consulting engineer at the darkest hour. The figures for 1907 give an excellent idea as to how the mine stands now. The method of treatment is by dry-crushing in Griffin mills, roasting, fine-grinding, and filter-pressing. During 1907 the amount treated in this way was 199,958 short tons, and the recovery of gold was 80,927 fine ounces, realizing £344,131. The average grade of ore treated was 8½ dwt., and the recovery just over 8 dwt. The amount treated was 30,764 tons more than in the previous year, an increase due to the provision of additional crushing plant. At the same time the average grade of the ore decreased from 10¼ dwt. to the figure above mentioned. After paying working expenses, the cost of development, and allowing for depreciation, a net profit was made of £96,843. Out of this, dividends absorbing £69,972 have been paid, which is 5% on the nominal capital of the company. The finances of the company are in good shape, for the plant, equipment, and development account stands at only £26,435 on the balance sheet. The high figure of the nominal capital, £1,399,459, is a relic of previous days, and it makes the rate of dividend look small. Another relic of the same sort is the appearance of a loan of £49,470 to Frank Gardner as an asset in the balance sheet. No doubt the directors hope to realize this some day, or they would have written it off. It will be remembered that Mr. Gardner used to be the controller, and this loan looks a little irregular. To be quite just to Mr. Gardner it should be mentioned that in the early days of the company he provided large sums of working capital, which were afterward repaid out of profits at a time when money was not easily obtained. As regards the present outlook, the ore reserves are figured at 461,598 tons containing 7½ dwt., as well as 161,597 tons of probable ore. During the last few years the amount of exploration and development work has been large, and the engineers now consider that the ground is so well known that the expenditure in this direction will be much less in future.

BISBEE, ARIZONA.

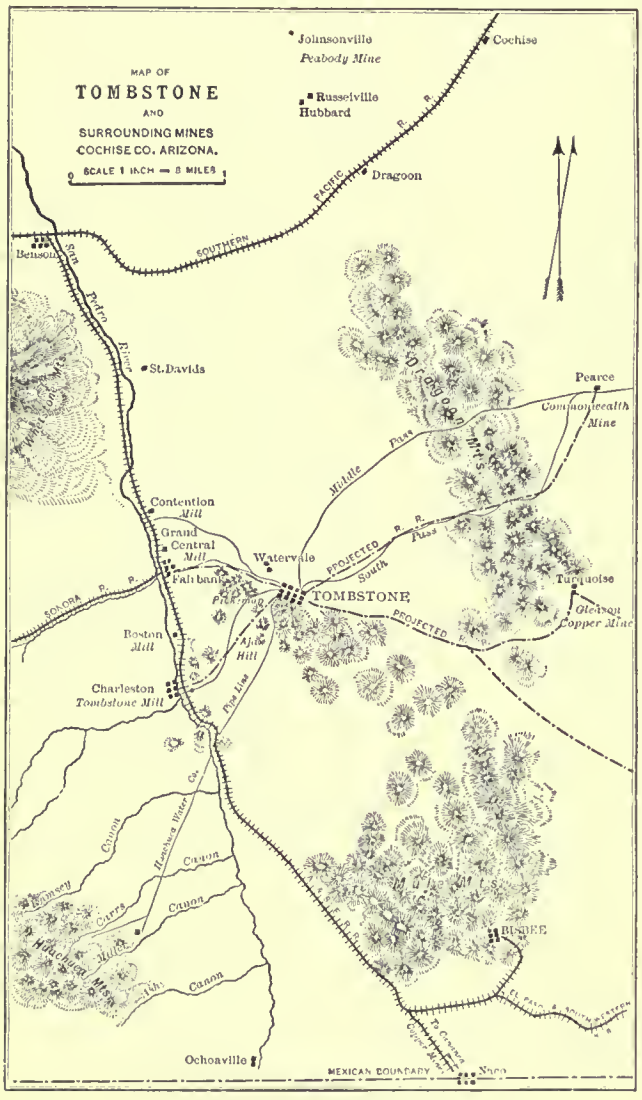
Copper Queen.—Electric Haulage.—Concentrating Traffic in Sacramento Shaft.—New Orebodies Found.—Calumet & Arizona.—Superior & Pittsburg.

Although the ore production in the Copper Queen is still slightly below what it was during the times of greatest activity, a normal number of men are employed, and a large amount of prospect and improvement work is being done. The most important piece of underground improvement being carried on is the preparation for the new electric haulage system. This will be in operation as soon as the necessary underground and surface work can be completed. Instead of hoisting the ore as at present through five different shafts, it will all be raised from one shaft, the Sacramento. The haulage drifts are on every other level, beginning at the 400-ft. From the Gardner to the Sacramento the drifts are on the 400, 600, 800, and 1000-ft

levels, and from the Lowell to the Sacramento on the 1000 and 1200-ft. levels. The drifts from the Gardner are completed; those leading to the Gardner from the older shafts are now being widened, and made higher where necessary; while the Lowell drifts are not completed as yet but are being driven ahead as rapidly as possible.

The Lowell shaft is now being sunk from the 1300 to the 1400-ft. level and has reached a depth of 1350 ft. From the 1400-ft. level drifts will probably be pushed at once toward the Hoatsou side-line so that ground on the Queen side of the dividing line can be prospected. This territory is already proved to a large extent by the excellent ore developments on the Hoatson 1200-ft. level, which is about 20 ft. below what will be the Lowell 1400-ft. level.

During the past few months the Copper Queen management has been devoting more than the usual amount of



Southeastern Arizona.

attention to the development of its unexplored property, paying particular attention to the country south of the Dividend fault, which cuts off the ore-bearing limestones from the barren Pinal schist in the northern part of the property. This prospect work has brought to light several new orebodies of promise, the most important recent discovery being a large body of sulphides lying between the Holbrook shaft and the fault on the 500-ft. level. The drift in which this discovery was made has already passed for some distance through good ore, and a cross-cut has shown the orebody to be of considerable width as well. Ore has previously been encountered in this section of the mines on the levels above, but there has been no evidence to show that it extended to this depth. Work is still going on to ascertain the actual dimensions of the orebody, and on the assumption that it extends downward for at least 100 ft., one of the main drifts on the 600-ft. level is being pushed out to this section of the mine. In the southwestern part of the property, on the Uncle Sam claim, which is bounded on the southeast by the Shattuck property, a new shaft has been sunk to a depth of over 400 ft. and is still being carried down at the rate of about 100 ft. per month. As yet no ore has been found in this region, although at about 350 ft. the shaft passed through one of the numerous porphyry dikes which penetrate the limestone, and which in many instances have been found closely associated with good ore. Recently some good oxide ore was found in one of these porphyry dikes near the limestone contact on the 200-ft. level in one of the cuprite drifts. This orebody has not as yet assumed dimensions of importance, but it is considered a good prospect, and a winze has just been started to follow it in depth.

There are still a large number of unemployed men in camp, but less than two months or so ago. A few new men are put on at the mines each day, but merely to take the places of those leaving, without any increase in the force.

At the Calumet & Arizona during the past few months particular attention has been paid to blocking out the ore, so that with no new discoveries the present production could be maintained for a long period of time. In the Oliver, on the 1250-ft. level, large bodies of high-grade sulphide ore have been recently opened. Within two weeks there has been a good body of oxide ore opened up about 1000 ft. southwest of the shaft, in entirely new country. Prospect work which has recently been started on the 1250-ft. level of the Irish Mag has not as yet resulted in the discovery of any ore. At Douglas the Calumet & Arizona smelter is handling as large a tonnage as ever before in its history, the average being a little over 1500 tons daily. Of this, nearly 800 tons is from the Calumet & Arizona mines and the remainder from the Superior & Pittsburg.

The Junction shaft of the Superior & Pittsburg, in spite of the heavy flow of water, was successfully sunk from the 1200 to the 1400-ft. level. On the 1300-ft. level the pumps are installed and driving has proceeded several hundred feet from the station, with no ore developed as yet. On the 1400-ft. level the station is not completed. The pumps on the 1000, 1200, and 1300-ft. levels are now handling 3600 gal. per min., which includes water from the Hoatson workings. No oxide ore is now being shipped from the 900 and 770-ft. levels, but a small quantity of high-grade sulphide ore is being mined on the 1200. The Hoatson shaft is shipping about 300 tons per day, almost entirely from the stopes on the 1200-ft. level. These stopes contain both oxide and sulphide ore of high grade and extend about 300 ft. along the west side-line of the Del Norte claim, which borders on the Copper Queen property. Development work on the 1300-ft. level is being pushed ahead rapidly; toward the north end of the claim a few seams of chalcopyrite have been encountered, and in the centre of the claim, 200 ft. south of the shaft, oxide ore of fair grade has been found, which, taken with the location of the ore and the dip of the limestone on the 1200-ft., promises well for the future of this level. No work will be done at the Briggs shaft until cross-cuts from the Junction drain the surrounding territory sufficiently to allow sinking without great expense.

The Cole shaft is producing about 300 tons of oxide ore per day, principally from the old stopes. The two new orebodies discovered within the past four months are yielding a considerable quantity of high-grade ore. These orebodies are between the Cole shaft and the Oliver of the Calumet & Arizona.

The Shattuck-Arizona Co. at present has about 25 men employed, all engaged in development work on the 600, 700, and 800-ft. levels. About the same number of men have been employed since the mine stopped shipping ore in November. Most of the work has been in new territory, and the results have been satisfactory to the management. The bids on the smelter are all expected to be in this week and will be sent at once to the directors in Duluth. At the Denn-Arizona the third diamond-drill hole is being sunk from the 1100-ft. level. Aside from this nothing is being done.

SEARCHLIGHT, NEVADA.

Hart, California.—Active Development.—Water-Works Installed.—Jumbo Shaft Being Sunk by Quartette Co.—Big Chief Adit.—Development in Signal District, Arizona.

The Hart district occupies the southern portion of the detached Piute range of hills, 25 miles west of the Colorado river, situated mostly in San Bernardino county, California. The town of Hart is at the base of this range, 25 miles south of Searchlight, Nevada, and is three miles from Hitt station on the Santa Fe branch that extends from Barnwell to Searchlight. Stages and automobiles meet all trains at Hitt, and an automobile line has been established between Searchlight and Hart. The town is supplied with water by pipe-line, through which it is pumped from wells at Barnwell. This was put in by the Rock Springs Cattle Co., which controls the wells and pumping plant. The water is discharged into storage tanks at Hart, and at present it is delivered in barrels to consumers. The town has about 400 people and the usual representation of business houses, among them a good hotel. A business men's league has been organized, which has done effective work in many directions. Its avowed purpose is to encourage legitimate mining. This league has also a law and order committee to assist in the maintenance of a quiet camp. The claim-holders and lessees seem to be a conservative lot of men.

Searchlight, Nevada.

The first locations in the district were made on Dec. 19, 1907, by J. H. Hart, Bert Hitt, and Clark Hitt; after these came the Foster Brothers and Andrews & Marsh.

This detached range trends north and south and is about five miles long and three miles wide. It consists of a series of peaks and spurs, some of which are connected by saddles and others are divided by deep ravines, exposing the formation. The country is rhyolite and rhyolite breccia, with three parallel zones of altered rhyolite running in the same course as the trend of the range. The gold is in the free state, disseminated through the gangue in finely divided particles. Much of it is so fine as to be invisible except with the aid of a magnifying glass. In some places there are fairly well-defined veins within these zones, but as a rule the diggings, which extend from 10 to 60 ft. deep, show the gold-bearing rock to be in masses of irregular shape. While many specimens run phenomenally high, it is believed that a general average of the ores of the district will not be far short of $20 per ton. The locations controlled by Hitt & Hart, Geo. A. Foster and associates, and Andrews & Marsh quite thoroughly cover the three parallel zones above referred to, but these parties have given a number of leases running from 1½ to 2 years, and under these the greater part of the exploring and developing of the district are being done. There are not less than twenty places in which lessees are at work, sinking and driving on outcropping lodes. The Big Chief Mining Co., controlled by the Foster Bros. and some Goldfield associates, has a lease from Hitt & Hart on the east zone. This ground covers both sides of a prominent spur. To open the lode outcropping on the crest cross-cuts are being driven from both sides, whereby a depth of 300 ft. will be gained. A shaft being sunk at the east side of this hill has struck what is reported as high-grade ore. The Pfunder and Todhunter leases, in the same locality, have encouraging showings. Andrews & Marsh, controlling the Oro Belle Mines Co., have ground which they are developing adjoining the Big Chief.

The Quartette Mining Co., which operates the Quartette mine and mill at Searchlight, has a bond and lease from Foster Bros. on the Jumbo group, situated on the west zone. This company has installed a gasoline hoist, erected a head-frame, and is sinking a shaft, which is down 60 ft. They will continue to 100 ft. and then do some driving. G. F. Sloan has a lease on a block of Jumbo ground, on which he has a 50-ft. shaft in ore that is a good average for the district. Hitt & Hart, who are themselves developing a block of their Oro Belle No. 1, report rich ore in various workings, which include a 160-ft. adit and one or two shafts.

John D. Shaffer has some promising locations at the southern end of the district, and John O'Keefe and associates of Goldfield have claims covering Twin Peaks, situated half a mile east of the Big Chief ground. This is leased to J. F. Smith, J. C. Howe, H. W. Lauck, and F. L. Earll, who have sunk a 50-ft. shaft, in which free gold is found in a saccharoidal quartz. Hart, Hitt, and Foster have installed a Little Giant quartz-mill, made in Portland, which is now operating. It is run by a gasoline engine, the ore being crushed by a rocking muller. The Hart Mining & Leasing Co. has been organized by G. A. Marsh, W. B. Andrews, and others, and has taken several properties for development.

H. M. Banfield, manager of the Garvanzo Mining & Milling Co., is making arrangements for the building of a 25-ton reduction plant, which is expected to be in readiness within 90 days. Sinking has been resumed at the Sunrise, where a 7-ft. body of medium-grade ore has been opened up the past two days while driving on the 50-ft. level. The property has been leased to Goodwin Felix & Todhunter. G. F. Sloan is in Los Angeles purchasing for his lease on the Jumbo. At a depth of 50 ft. cross-cuts have been run east and west, and the lode prospected for a width of 45 ft., which is all of milling grade. Phelps & Eagan, lessees of Block 3, Oro Belle, have started a new shaft 100 ft. north of the Big Chief adit on the west side of Big Chief Mtn., cutting an 8-ft. vein.

The opening of the Norton house, Hart's new first-class hotel, was celebrated last Friday evening with a banquet and ball. An elaborate menu was served, and with Harry S. McCallum as toastmaster the affair proved a huge success. The furnishings in the Norton house are first class. Another two-story business block was started this week by Martin & Nance.

The McCracken Hill mines, situated in Signal district, Arizona, 40 miles from Yucca station, are owned by an eastern company, of which John L. Witney is manager and Albert Burch consulting engineer. Extensive development is in progress on a great silver-lead vein whose outcrop is traceable for a distance of 10,000 ft. through a gneiss and grano-diorite country. The vein is of great width. The ore consists of lead carbonate and silver chloride near the surface, and of galena and silver at greater depth. A 400-ft. incline three-compartment shaft has been sunk on the vein and further sinking is in progress, with horizontal workings on the vein. Gasoline engines, using distillate as fuel, furnish the power. The company is putting in a 20-mile pipe-line, through which a water supply will be brought by gravity. A force of about 75 men is employed. This locality is 14 miles north of the Bill Williams fork and 70 miles by road from Parker.

DENVER, COLORADO.

New Railroad Begun.—Gilpin and Adjoining Counties.—Clark Buys Coal Lands.—Activity at Steamboat Springs.—Franklin Mining Co.—Fremont Coalfield.—Cripple Creek Output.

The construction of the Denver, Laramie & Northwestern railroad was begun on May 2 at Denver, with appropriate ceremony. When complete the line will be of great importance to Denver, as it will afford direct connection with Seattle, and open up rich agricultural lands and previously inaccessible mining districts in Wyoming and Idaho.

Mining in Gilpin and adjoining counties is being actively carried on as the season advances. At Central City a new gasoline hoist has been installed at the War Dance mine. A large electric pump is being set at the 1300-ft. level of the Cook shaft, which is on the property of the King Bee Mining & Milling Co. Several of the producing mines are shipping steadily and others are undergoing vigorous development. An order for 40 new cars has been placed by the manager of the Newhouse tunnel. The cars are much larger than the present ones, and are rigidly constructed to withstand dumping by derrick, which is to be tried. The Wano mill at Jamestown has begun to treat ore again. Sufficient water is now assured for steady operation.

Senator W. A. Clark has taken up the option which he held on 12,000 acres of coal-land near Stonewall. Development work on an extensive scale will start at once on the property, and a spur line will be laid from Trinidad. The object is to furnish coke to the United Verde smelter at Jerome, Arizona. A great deal of development work is being done on properties near Steamboat Springs. The owners of mines in this district are making every endeavor to have their properties ready to ship ore as soon as the Moffat road reaches there. Prospectors are very active all along this new line. At the recent annual meeting of the Franklin Mining Co. in Boston three new directors were elected, and Steven R. Dow made president to succeed F. H. Raymond. This company operates largely in Colorado by leasing.

Recent explorations in the extreme southwestern portion of the Fremont county coalfield show the coal area much thicker and of wider extent than formerly supposed. The first seam was encountered at 300 ft. In the next 536 ft. 33 distinct seams were passed through. Further prospecting outside the known area and at greater depths is going on. Cripple Creek finished the month of April with a gross tonnage of 64,023 tons, which exceeds that of March by 3000 tons. The gross value was $1,346,380, being $38,700 less than for the previous month. The local cyanide mills treated nearly 12,000 tons of the low-grade material. The new Stratton's Independence mill should add materially to this amount for May. The excessive low-grade tonnage from nearly 100 dumps that are being worked by lessees cut down the total value of the product. Square-set timbering has been resorted to in the Portland mine, to support the walls of the abandoned stopes between the fourth and fifth levels. When the miners had completed the difficult and dangerous work on April 22 each man received a present of $50 in gold from the company.

As spring advances there is increasing activity among the smaller properties at Leadville, and especially in regard to schemes for development of the adit. For many years this plan was frowned upon in Leadville. The principal mining areas are of gentle slope, in which adits gain depth but slowly, and the life of the mines was expected to be short until the deposits at lower levels were discovered. J. F. Horner has completed arrangements to drive an adit from the Shields mill-site northwest through the Red Bird, Tiger, Venture, Welsh, and other properties—a total distance of about one mile. The Home Co. proposes to drive an adit 3000 ft. long at Granite to cut the veins on the Yankee Blade, Robert George, Magenta, Bunker Hill, Washington, and other properties. Mining in a desultory way has been carried on in the Granite district since 1868. During the three years following the first discovery an important production was reported from the various shallow workings, among which the Yankee Blade was most prominent. After a period of inactivity Granite experienced an awakening in 1894, and active mining continued until the sulphide zone was reached, and the abundance of water made operations unprofitable. It is believed that the new adit will bring the Granite district once more into the producing rank. Since the lessees on the Hibschle at the head of Eighth Street completed the improvements on the shaft, shipments have gradually increased until they amount to 100 tons daily. This ore is principally manganiferous, although the strike made recently in the Wolcott workings adjoining the Hibschle was principally lead. The present workings of the Hibschle are several hundred feet from the main shaft and at a depth of about 500 ft. While Robinson is not in the Leadville district proper, the International Mining Co. has attracted much attention, local capital being interested in the enterprise. At present 60 tons daily is being shipped to the smelters. Developments on the orebody show a strong shoot of iron-sulphide, which is accompanied by the usual lead and zinc ores characteristic of the district. About 400 tons per month is being shipped from the Hilltop property in the Horseshoe district to Kansas smelters. Repair work on the Ohio & Colorado smelter at Salida has been completed and the capacity of the plant increased one-third.

BUTTE, MONTANA.

Barnes-King.—Boston & Montana Directors Elected.—Montana Mining Association.—Large New Chimney at Great Falls.—Reduced Cost of Production.

For the first time since the organization of the Barnes-King Development Co., the mine more than paid expenses during March and April. The detailed report for March shows that 5655 tons of ore were milled during the month, the bullion output plus the tailing at 49c. per ton, giving an original ore-value of $4.97 per ton. The bullion was 1791.25 oz., for which the United States assay office paid $25,320.13, less assaying charges of $119.80. Twenty-five per cent of the men employed underground are engaged in development work. General Manager McGee continues hopeful, and some of the stockholders in Butte, who paid $5 per share for stock now selling at 60c., even see the remote possibility of small dividends.

The annual meeting of stockholders of the Boston & Montana Consolidated Copper & Silver Mining Co. was held in Butte recently and the old directors re-elected: Sidney Chase and James Phillips, Jr., of Boston; David B. Hennessy and Andrew B. Grafius, of New York; and John D. Ryan, of Butte. Out of the 150,000 shares of stock, 149,541 were represented at the meeting. No other business was transacted.

A. H. Wethey, general mine manager for W. A. Clark, says the report that Clark has sold his Montana interests to the Amalgamated Co. is not correct. Mr. Clark is making a trip through Arizona and California, and is expected back in Butte about May 15. Clark's interests in Butte include the Stewart, Original, and Elm Orlu mines; the Butte Reduction works, the street railway system, a bank, and other properties.

It is announced by officers of the Montana Mining Association that the Association's smelter at Ponderay, Idaho, will be ready to receive ore about May 18, with a capacity of 250 tons of ore per day to start with. The Association is now negotiating with the Great Northern and Northern Pacific railroads for rates, which, when made, will have to be approved by the Inter-State Commerce Commission. The Association does not expect any difficulty in getting favorable rates. It is expected that the smelter will do much for the mining industry of Montana, as it will stand in the way of future prohibitive rates by the 'trust' smelters.

Work on the big stack at the Great Falls smelter of the Boston & Montana Co. is well under way, and it is expected that it will be completed by October 1. The stack will be 742 ft. above the blast-furnace charging-floor, being situated on a high point above the smelter. The actual height of the chimney above its foundation will be 506 ft. It will have a diameter of 74 ft. The flue which is being built to

connect the furnace with the stack will be 1800 ft. long, and 1450 ft. of it will be 48 ft. wide and 20 ft. high, while the remaining 350 ft. will be 175 ft. wide and 20 ft. high. The big chimney, when completed, is expected to carry off every minute 4,000,000 cu. ft. of gases. About 100 men are employed on the work, including 50 expert high-chimney men. It is stated that the chimney was planned to meet any contingency regarding the Washoe smelter, as the Great Falls plant could then easily be enlarged to handle all the ore of the Amalgamated mines.

The present copper production of the Amalgamated, North Butte, and Butte Coalition companies is at the rate of about 26,000,000 lb. per month, and it is asserted by the officers of the companies that the average cost is less than 10c. per lb. That the companies are making cheaper copper than formerly is evidenced by the fact that during the past week orders were issued to all bosses to send lower grades of ore to the smelters.

On account of the long shut-down of the mines prior to March 1, the net proceeds of mines for the year ending June 1 will show a decrease from that of the preceding year of about $14,000,000. The net proceeds for the year ending June 1, 1907, were about $23,000,000.

TORONTO, CANADA.

Cobalt Company's Title Confirmed.—Ontario Legislature Disregards Vested Rights.—Government Interrogated on Lawson's Yukon Gold.

The Canadian Government, which was urged to disallow the act passed last year by the Ontario Legislature confirming the title given by the Provincial Government to the Cobalt Lake Mining Co. in view of a claim put forth by the Florence Mining Co. on the ground of prior discovery, has refused to interfere. The matter has for some time been receiving consideration by A. B. Aylesworth, Dominion Minister of Justice, who reported to the Government in favor of non-interference on the ground that the Provincial act is clearly within the jurisdiction of the Legislature as defined by the constitution, as it concerns property and civil rights which fall within the scope of Provincial legislation. Theoretically the Dominion Government has the power to review and if it so pleases to annul any Provincial legislation within one year from the time of its enactment, but the Minister of Justice held that it was not advisable that the Federal authority should consider the justice or propriety of Provincial laws, so long as they were clearly within the jurisdiction of the Legislature. At one time the opposite view prevailed and Canadian Governments undertook to pass upon the Provincial measures, but lately the tendency has been to restrict the exercise of the power of disallowance to cases where the Legislatures exceeded their constitutional limitations, and not to veto legislation simply because it is bad in principle. With this decision the action of the Florence Mining Co. to recover the property, which was suspended until the disallowance question was settled, falls to the ground, and the title of the Cobalt Lake Co. is apparently secure against further attack from any source. But the result will hardly tend to create a feeling of security on the part of American investors in Ontario mining properties, as it renders the Legislature, that is to say, the Government of the day, practically free to deal with their holdings as they please, or as suits their interest, without any sort of check on the action of a Legislature of a single chamber entirely subservient to the administration. 'Vested rights' is a term quite without significance in the dealings of the Ontario Government with mine-owners.

The attention of the Canadian Government is being called to Lawson's Yukon Gold Co. flotation, Claude Macdonell, one of the parliamentary representatives of Toronto, having given notice of a series of questions which he will put in Parliament with the object of ascertaining the true status of the company. He will ask whether the statements made as to the holdings of the company in the Yukon are correct, and if any were incorrect or misleading what steps were taken by the Government to warn or protect the public that was asked to invest.

MEXICO.

Carrizo Smelter.—Casados Consolidated.—El Tajo.—Lawson's Expenditures at Mascota.—Parnaso District.

After a little over two years of hard work and patient endeavor the Carrizo Copper Co., in Ayutla, Jalisco, has about completed its little 50-ton smelting plant and is now in the market for custom ores. In addition to the products of its own mines, this company has the mines and mill of the Ayutla Copper Co. under lease, and will smelt the concentrate from that mill, which has now been in operation for six months or more. The Carrizo plant should prove a boon to the many small copper-producers around Ayutla, Autlan, Purificacion, and throughout that region, for it is a long and expensive haul to the railroad station at Ameca or to the Pacific coast, and the smelter, by reason of concentration into matte and a material reduction in the volume of freight, can offer considerably better terms than it has been possible to obtain at this distant point. Kent E. Keller, of St. Louis, has been unceasing in his efforts to bring this property to a successful stage, and he now expects that before the end of May the blast may be turned on and smoke be pouring forth from his stacks. Because of the great expense of getting coke into Ayutla, as much charcoal as possible will be used with the coke in smelting, and the greatest economy will be practised at every point. The plant is built so that the capacity may be increased as the business demands.

Another Jalisco property which is fast approaching the successful line in the procession is the Casados of the Consolidated Mining Co., in the Hostotipaquillo district. This property was bought and the company organized by W. R. Ramsdell of Etzatlan, and is one of the few that has borne out the old traditions of encountering rich ore just as the water came in and drove the old workmen out. The shaft and old workings were unwatered without a great deal of difficulty, and the rich ore found as had been claimed. A great deal of repair work throughout was necessary, however, so that something like ₱50,000 has been expended to date, but the company is now shipping a high-grade product to the Torreón smelter and the second grade is being sent to the near-by Amajac reduction plant (patio and cyanide) of Carlos Romero, pending the development of the property sufficiently to warrant the erection of its own concentrating and cyanide plant. West of Hostotipaquillo, near San Sebastian, also in Jalisco, the development work in both the old workings and the new tunnel on El Tajo, operated by the MacKeever Bros., is said to have opened up sufficient ore to run a fair-sized plant for several years, and orders have been placed for a 30-ton stamp, table, and cyanide experimental plant to thoroughly determine the needs of the ore.

A day's ride to the south from San Sebastian is Mascota, the headquarters for Thomas W. Lawson's Mexican company, and east of which, about two or three hours' ride, are the principal holdings, some 138 scattered pertinencias (340 acres), for which it is said $165,000 was paid and $500,000 spent on development work and plant. In the little narrow arroyo of Tethuana is situated his pretty San Gregorio 30-ton cyanide mill, on which $250,000 is supposed to have been expended; though probably the greater part went into the magnificent wagon-road over the mountain and through the woods to the saw-mill which was put in to furnish timbers and lumber for the erection of the cyanide-mill. These form the basis for the $5,000,000 company organized in Boston, and after a hurried trip over the country one could not help being reminded of Lawson's 'Frenzied Finance' and the 'Lambs.' West from Mascota about a day's ride, at a place called El Moral, the company is supposed to have a cinnabar mine and furnaces.

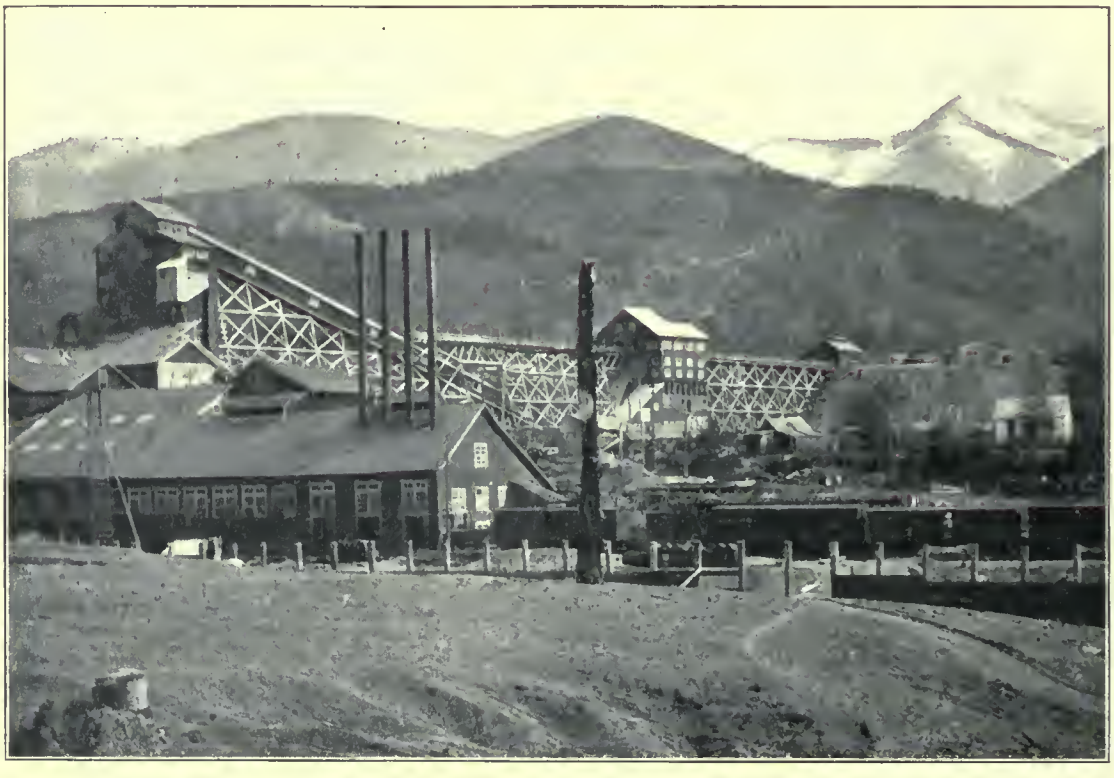
The owners of the Boca Ancha, in the Parnaso district, have completed their 50-ton concentrating and cyanide plant for the treatment of the old dumps, and while steam is at present being used, an electric plant is being designed for erection on the Parnaso river, on the completion of which more active development work will be inaugurated at the mines.

FROM MINE TO BATTLESHIP.

The Story of the Manufacture of White Lead Paint.

Written for the MINING AND SCIENTIFIC PRESS
By T. A. RICKARD.

The original source of the white paint that protects the steel of the battleships now gathered in the Bay of San Francisco is the lead ore of a mine. The smart appearance of the serried squadrons is due to the pure pigment manufactured by a series of intricate processes from the mineral broken many hundred feet underground by the labor of the miner. From the dark and cavernous openings of the underworld has come the substance that now gleams in the sunlight of California. Many mines produce lead ore and many smelters extract the metal from its earthy matrix. The Selby smelter, at the northeastern end of the Bay of San Francisco, is the most important establishment of its kind on the Pacific Coast and it supplies the white lead used at the Mare Island navy yard. Of the mines from which ore is sent to the Selby works, the most important is the Bunker Hill & Sullivan in Idaho. It is my purpose to trace the lead ore from the mine to the smelter, and then to follow the lead from the furnace to the plant in which the white lead pigment is prepared, thence to the navy yard, where it is laid upon the sides of a battleship. It is the story of a complex industrial process.



Main Mill Building. Ore-breaker. Kellogg Adit.

The Bunker Hill & Sullivan Mine and Mill, at Wardner, Idaho.

Extraction in the Mine.

The Bunker Hill & Sullivan mine is the most important single lead-producing mine in America. It produces 40,000 tons of lead and 1,650,000 oz. of silver annually. Since its discovery this mine has paid $10,146,000 in dividends. The property is situated at Wardner, in the Coeur d'Alene, Idaho; it is a picturesque region, mountainous and forest-clad. To the picturesque in nature has been added the romantic in human history, and to these have been superadded the horrors and brutalities of industrial warfare, for in 1899 and for many years thereafter this locality was the scene of a bitter struggle against the worst forms of labor unionism. On April 29, 1899, the large concentrating mill of the Bunker Hill & Sullivan Mining & Concentrating Co. was destroyed by an explosion of dynamite, placed by rioters. The accompanying picture shows how the ruins appeared, and it will be seen that the only cheerful feature of the scene is the flag that floats undaunted at the top of the mill. It was hoisted after the explosion, when the troops came to restore order, for Frank Steunenberg, the Governor of Idaho, subsequently assassinated for doing his duty, had said that his purpose was "to bring Idaho back into the United States." Order was finally restored and Wardner became a peaceful settlement once more, but not before representative government had been severely tried.

This mining property, which became so famous by reason of the labor troubles and which later proved to be so magnificently productive, is a consolidation of many claims, the first of which was located in September 1885. From time to time, the territory controlled by the company has been increased by purchase, until now the group of claims covers about 3000 acres. From the very beginning the production of silver and lead has been almost uninterrupted; what stops there have been were due not to any exhaustion of ore reserves but to unsatisfactory metal markets or to disturbed labor conditions. The

productive zone of this property is known to be over two miles long and the deepest opening is 2200 ft. below the surface of the mountain into which the mine workings extend. The accompanying photograph shows the mill and the entrance to the main adit, which is named the Kellogg tunnel. It can be seen just above the small building on the right, and penetrates the mountain in the background.

The mine is said to have been discovered by a donkey, who strayed from his owners and was found standing on the ore; he had pawed the ground so as to remove the turf covering the outcrop of the lode. The incident is related in the judicial records of Idaho. Early in the history of the mine there was some litigation and Judge Norman Buck of the District Court said in his decision that: "From the evidence of the witnesses, the Court is of the opinion that the Bunker Hill mine was discovered by a jackass, Phil O'Rourke, and N. S. Kellogg; and as the said jackass is the property of the plaintiffs, Cooper and Peck, they are entitled to a half interest in the Bunker Hill, and a quarter interest in the Sullivan claims." In other words, it was decided that Cooper and Peck, merchants in the neighboring town of Murray, had grubstaked or outfitted Kellogg and O'Rourke.

The rock in which the ore is found is a very old quartzite, formed by the metamorphism of sandstone, which has been twisted, crushed, and distorted by geological movements. In the cracks and fissures formed by such movements, the lead ore has been deposited as galena, which when pure carries 86.6% lead, and 13.4% sulphur. With it is associated a nearly fixed proportion of silver, in the ratio of one ounce of silver to 44 pounds of lead. The parts of the mine from which the ore is extracted are irregular in shape, although the continuity of the lode and a certain rough alignment of the orebodies within it have become emphasized by the operations of many years. When I visited the mine in 1904 the Kellogg adit was 12,000 ft. long and a new orebody had just been discovered at the face or eastern end. The quartzite appeared to be full of slips and fractures, which serve as local boundaries for the richer bodies of galena. A main foot-wall marked the southern limit of the ore-bearing zone, which had a dip of 50° southward. The galena replaces and impregnates the brecciated quartzite along channels created by the fractures extending along this foot-wall and away from it into the overlying rock. Fig. 1 is a sketch of one of the headings.

The Bunker Hill Mill After the Explosion on April 29, 1899.

The photographs, taken by flash-light, will illustrate the appearance of the stopes where the lead ore is being extracted. These openings are from 100 to 140 ft. wide, and they have been made as long as 1500 ft., leaving cavernous spaces that would entail dangerous falls of rock if they were not filled subsequently with waste material, as the ore is removed in the course of mining. No less than 4,500,000 ft. of timber is used annually to sustain the ground and protect the workmen until the cavity or stope is filled with waste broken in cross-cuts and other exploratory openings of small size. Despite these precautions accidents do occur, although they are rarely

fatal. Occasionally the mishaps to the miners lead to deeds of heroism and to the display of technical ingenuity in making a rescue. Thus only a month ago there was a collapse of rock separating a new stope from an older excavation overhead. On March 26, the rock between the two openings of the Kemp stope on No. 10 West, as it was known to the foreman of the mine, showed signs of caving. (See Fig. 2.) Two timbermen were sent to 'catch up' the caving ground and make it secure. The miners were withdrawn from the stopes. At 3 o'clock in the afternoon the ground began to cave badly, filling the manway and chute from the western portion of the stope and falling to the level below. An immediate examination indicated that there was no apparent possibility of extricating the timbermen. Just as fast as the broken rock was drawn out of the chute and manway (C), to the No. 10 level, in endeavoring to clear a way to the place where the men were supposed to be, the caved material would settle in the upper stope and induce a fresh collapse from overhead. To overcome this condition, long timbers were formed into a mat (A) and on this other timbers were piled in the upper stope, beneath the point (B) where the caving was worst. Then the material was drawn as quickly as possible at the level below through the chute at C. Many hundred tons were removed and this caused the mat of timbers to descend. The ground continued to cave until the mat reached the top of the chute and manway, where it stayed, sealing these openings so that finally they could be emptied from below, and at the same time this mat of timbers afforded protection from the caving still in progress above. This was accomplished by 10 o'clock at night and the rescuers, climbing up the manway, found one of the timbermen a short distance from the head of the passage and pinned in a narrow space (X) between masses of rock and timbers, yet enough to one side to have escaped being crushed by the descent of the rocks that had swept down the manway and chute. He had been in the greatest danger and would inevitably have been killed had any other method been adopted. This man stated that his comrade was in a small drift (Y) leading from the stope, now completely sealed by the fallen rock. It was decided that to drive through the cave and the mat of timbers was impracticable, the entrance to the drift being above the timbers. Therefore the manager, who led the rescue-party, decided to make a passage through solid rock from the top of the manway. Communication with the imprisoned man was established by an air-hose, which happened to be connected to a machine-drill standing in the drift close to the timberman, and by actual conversation through this tube it was ascertained that he was unhurt and had plenty of air. Blasting had to be avoided, although the ground was "quite stiff," on account of ventilation for the rescuers and for the imprisoned man. The shock of a blast was pretty sure to start more caving. So the entire distance of 15 ft. was cut out by Waugh stoping-drills, fitted with a chisel-bit. In 17½ hours the rock was cut out in blocks and the interior drift was reached, the man being taken out at 7:30 in the evening, after facing death for 28½ hours. Thus even the lead that yields the white paint on the battleship in San Francisco bay is not without incidents as thrilling as those of naval warfare, and not without the exhibition of a resourceful courage such as an admiral might envy. For the manager of the mine, Stanly A. Easton, worked without cessation for 29 hours, directing the rescuers and leading the way to the rescue. And when it was all over and the two timbermen were safe in their homes, he wrote to the president of the company thus:

"This gives a new application for the useful Waugh drill. One machine did practically the whole work, running constantly for fifteen hours, there being relays of four men, who practically held the drill up to the face for its work with main strength, in the same manner as coal punchers are handled. The ground was too hard for any progress to be made through it by picking and mailing, and what would ordinarily be called stiff blasting ground. I am writing you complete details of this incident as you will no doubt see Associated Press despatches concerning it and also as there were certain methods used which, so far as I know, are entirely novel and which proved in this case to be exactly the right thing to do. The situation was a nasty one and we are mightily well pleased that both the men are safe and sound, which is due principally to the hard work of the miners in carrying out the plans agreed on by Mr. McDougall, Jones, and myself. It took just 28 hours of solid work to carry the thing through. The damage to the stope is insignificant, as the broken material is practically all waste from the hanging wall and no ore is either buried up or lost. The organization of the crew is disturbed for two days, but the output of ore seems to have fallen off but very slightly."

If the American fleet has many men like this, it ought to ensure America from invasion!

In the course of my examination of the mine in 1904 I walked through 4½ miles of workings. The additional work since that date has increased the length of the main workings to 6 miles, including the Kellogg tunnel, which is nearly 2½ miles long. Through this adit, which took 8 years in construction and cost over $200,000, the ore is hauled, by electric locomotives, to the mill. Every year, through the portal of this mine, there is brought enough ore to provide every man, woman, and child in the United States with one pound of lead, and even then there is some left over. Besides serving as the main entrance or adit of the mine, the Kellogg tunnel serves to ventilate the workings by connection with other and higher drifts and shafts penetrating the ground overhead. The mine is well ventilated and this is particularly necessary where lead ore is being handled, for lead is poisonous to the human system. However, the men rarely suffer from contact with it, immunity being due principally to the fact that the metal, when occurring as galena, the sulphide, is in an insoluble form and is not readily assimilated by the body. Furthermore, the dust is mitigated by sprinkling dry drifts, so that cases of lead poisoning are only at the rate of one or two in 10 or 15 years.

among 500 employees. Sanitary precautions are strictly enforced. About 80% of the men working in this mine are native born Americans, although many are of Cornish descent, their forefathers having been miners for many generations. Of the entire force nearly 60% are married and many own their own homes at Wardner and Kellogg, the adjacent towns. The Bunker Hill & Sullivan has been in operation so long that many of the miners and foremen have worked in no other mine.

At the time of my visit I watched the methods employed in breaking the ore. A sollar or platform, made of 3 by 10 in. boards, is laid on the floor of the stope and the ore is broken down upon this, some fine waste being spread on the boards to protect them from the blast. Machine-drills are used to

The Coeur d'Alene, Idaho.

drill the holes, which are 7 to 10 ft. deep, 2 in. diam., and loaded with gelatine dynamite, exploded by a cap to which a fuse is attached. After blasting, the larger pieces of quartzite are removed by hand (to be used as filling) and the remainder is shoveled into chutes or mill-holes, 25 ft. apart and lined with round poles, 6 in. diam. at the small end. These chutes lead from the stope-floor down to the level, through the stope that has been already excavated and filled. At the level the ore is drawn into cars, each of 3 tons capacity, formed into trains, and hauled by electric locomotives. The ore is stoped for its full width, so as to explore as well as extract. Ordinary drifts might go through almost barren ground within the core of an orebody. Fortunately the barren quartzite breaks in blocks while the lode shatters into small pieces, so that the larger fragments of waste are easily picked out for filling, while the ore is collected into chutes. If the output of a stope is hurried so that the rock broken is not turned over carefully and the lead gleaned before the next blasting, there is a loss due to burying the lead under quartzite. There is also an inevitable small loss through the galena left on the faces of rock that is retained as waste, and there is a loss from the pulverization of the mineral by blasting and breaking, but usually less than one eighth of 1% goes into the filling. Rarely a piece containing 2% may be lost and also some galena dust. The waste is occasionally

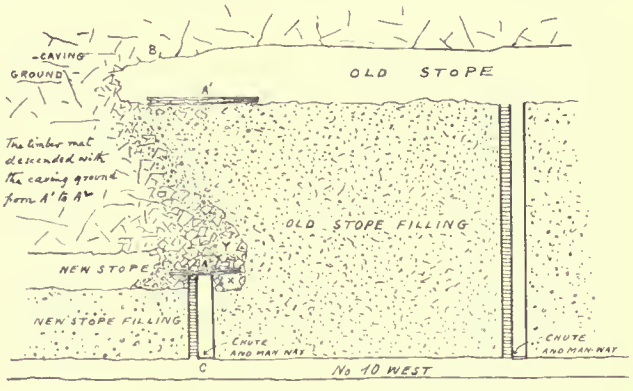


Fig. 2.

drawn from one stope to another and is then examined. The presence of a trace of moisture lessens the dust arising from the broken ore. In fresh rock the ground appears dry, but after a while the moisture exudes. This water is not acid; it contains iron in solution, derived from siderite, the carbonate of

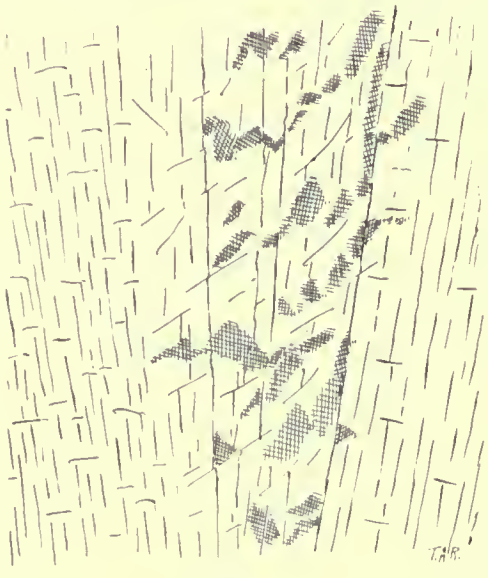


Fig. 3.

iron, which occurs in adjacent veins. At the surface the water from the mine precipitates iron hydrate, which dehydrates to ferric oxide.

The accompanying sketch shows the face of a small stope, the quartzite being more thinly laminated on one side than on the other, and with a different dip. The dark lead ore crosses the laminations of the zone of fracture in an irregular way. (See Fig. 3.)

After a visit underground, I climbed through old workings to the surface and saw the place where the lode was first discovered. The site is marked by a big open-cut situated close to the line of the Stemwinder claim. An outcrop of galena was found here and as the ridges of quartzite were prominent they

were assumed to be veins, although, as was proved later, the lode crosses them at a strong angle. In consequence of the first mistake, the claims were located across the strike of the lode, so as to cause numerous lawsuits arising from the interpretation of extra-lateral rights. As seen in the open-cut, the lode is a strong cross-fissure cutting the bedding of the quartzite along a sheer-zone marked by brecciation. The most prominent structural feature is the foot-wall, which limits the mineralization northward. The lead ore occurs within this sheer-zone, along the foot-wall, along the fractures that are roughly parallel to the foot-wall, and in irregular masses having a course that appears to be determined by the bedding planes of the quartzite, which, being shattered and disordered near the main line of fissuring (that is, the foot-wall) produces a confused mineralization, tending to more evident shape and direction westward as the orebodies extend away from the foot-wall. While standing at the point of discovery I found a piece of quartzite showing beautiful ripple marks, indicating that the metamorphism to which the rock had been subjected has not been able to obliterate the traces of sedimentation. The sight of those ripples, fixed in the hard quartzite that encloses the valuable ore, took my imagination back to that remote geological period, many million years ago, when the shallows of the Algonkian sea were ruffled by a gentle breeze, leaving its imprint indelibly recorded on the soft sand from which the alchemy of nature had fashioned an adamantine rock, now laboriously penetrated by man in his search for metallic wealth.

Treatment in the Mill.

From the mine the ore goes to the mill, where it is crushed, classified, and concentrated, so as to get rid of the worthless matrix of quartzite (and some siderite) and collect the valuable minerals in a clean and marketable material. Argentiferous lead, in the form of galena, constitutes the chief product, but there is also the iron pyrite, with which silver is associated in the final concentrate. The problem is to save the lead and silver without the zinc.

The electric locomotive pulls the cars (holding 7000 lb. apiece) to large storage bins; there the ore falls over grizzlies (parallel inclined steel bars 1¼ in. apart), the oversize going to a Comet crusher, size D, of the gyratory type, of which there are two, one being held in reserve for such times as repairs are needed. By this machine the ore is crushed to a maximum diameter of 2½ in. and then spills onto a horizontal picking-belt, where a couple of men are stationed to pick out the clean ore (galena) and the inevitable mine rubbish) by hand. This belt delivers to roughing rolls, and from them, after being reduced to a size of about 40 millimetres, the ore is discharged onto an incline belt-conveyor. Here it is joined by the undersize, which passed between the bars of the grizzly and is brought thither by another belt-conveyor.

The joint product is now carried to the top of the mill proper, a height of 100 ft. in a horizontal distance of 300 ft. There it is fed into a Vezin sampler, the sample extracted passing to another sampling machine of the same kind placed immediately underneath. Each sampler takes one tenth, so that one per cent of the whole is finally obtained. This sample is reduced and prepared for assay daily.

After sampling, the ore drops into the mill bins, which have a capacity of 600 tons, equivalent to a 12-hours supply. From the bins the ore passes through a pair of trommels, or revolving cylindrical screens, one for each of the two units into which the plant is divided. The upper section of each trommel has round holes of 18 mm. diam., while the lower section has holes of 36 mm. The oversize from the upper section goes to rolls (placed at the bottom of the mill) and is re-ground by other rolls, before being returned (by a bucket-elevator) to the same trommel. The size larger than 18 mm. but smaller than 36 mm. goes to the bull-jigs, which produce the three usual products, namely, concentrate, middling, and tailing. The first is shipped to the smelter. The middling is re-ground by rolls to the next size, the trommel sizes being 36 and 18 mm., as stated, followed later by 10, 7, and 3 mm. openings. At each stage of the re-grinding by rolls, the product is screened through these trommels, to be treated by jigs, until finally it gets below the 3 mm. diameter. After this reduction the middling from the remaining concentration processes is re-ground by Huntington mills, instead of rolls. The classification of the re-ground product (now less than 30 mesh) from the Huntingtons is effected in two ways, namely, by spitzkasten or pyramidal boxes, and by Callow settling-tanks. The overflow from the last goes to Frue vanners, while the underflow passes to Wilfley tables.

The finest revolving screen (or trommel) has apertures of 3 mm. diameter and after the crushed ore has passed through this, it is hydraulically classified, the sand being concentrated on jigs while the slime is conducted to a settling-tank, from which it is drawn for treatment (together with the re-ground product coming from the Huntington mills) on Wilfley tables and vanners.

Middlings from the 10, 7, and 3 mm. jigs, together with all the tailings from the sand-jigs, Wilfleys, and vanners, are carried by launders to the annex, where they are classified and dewatered by Callow screens, the oversize (above 26 mesh) being re-ground in Huntington mills, while the undersize is re-treated on Wilfley tables and vanners.

Among the principal features of the mill may be mentioned the re-crushing by rolls, the passage of the coarse middlings through the rolls, and the grinding of the fine middlings in Huntington mills. Water is used to wash the vanner concentrate into an orifice (at the bottom of the front boxes) leading to the bins. The end treatment, after classification, consisted, at the time of my visit, of four sets of jigs, the overflow from which went to settling-tanks, the middling from these finishing jigs being ground in Huntingtons while the fine overflow passed to Frues and the coarse overflow to buddles, followed by Wilfleys. The buddles are now no longer used and Callow screens form an important feature in the equipment. Card concentrators are now being tested, with promising results. It has been suggested that a

filter-press be employed to catch the fine galena carried in suspension in the mill-water; the result of such an experiment will be awaited with interest.

In March of this year the mill treated 30,600 tons in 28 working days. The ore assayed 12.56% lead and 5.07 oz. silver, so that the material treated contained an aggregate of 7,686,720 lb. lead and 155,142 oz. silver. The ratio of concentration was 4.6 into 1.

The yield, as determined by sampling and fire-assay, was:

Class.	Weight. Tons.	Lead. %	Silver. Oz.
First	1,169	76.8	28.6
Second	2,866	50.3	18.2
Slime	1,097	44.9	18.0
Middling	1,448	10.3	4.2
Total	6,580	45.3	17.0

Thus there was extracted 5,965,096 lb. lead and 111,598 oz. silver, the total recovery being 79.4% of the

Getting Ready to Blast Big Pieces of Ore.

lead and 71.9% of the silver, or 77.6% of the total lead and silver in the ore. Of the above mill-products, only the middling is re-treated, the others are

In a Stope of the Bunker Hill & Sullivan Mine.

shipped to the smelters at Tacoma (Washington), Selby (California), Pueblo and Denver (Colorado), Perth Amboy (New Jersey), and occasionally elsewhere. In the mill, 52 men are employed; the total cost of milling in March per ton of crude ore was 35.9 cents; this cost for many years did not exceed 21 cents per ton, and it has been increased by reason of the more complicated treatment adopted in order to obtain a higher extraction.

Besides the different concentrates saved in the mill, the mine yields a varying amount of selected ore, picked in the stopes and at the top of the mill, as previously described; this is shipped directly to the smelters. The proportion of this product sold from month to month depends upon the condition of the market. In March 250 tons only was shipped; this contained 58.8% lead and 19.2 oz. silver per ton. There have been months when as much as 3000 tons of such ore was sent to the smelters. The cost of producing lead, laid down at New York, in March, was 2.3 cents per pound. In the year ending March 31, 1907, the Bunker Hill & Sullivan Mining & Concentrating Co. mined and milled 336,630 tons of crude ore, the cost for stoping being $1.47; for exploration, 9.4 cents; for improvements, 30 cents; tramming from mine to mill, 7 cents; concentration, 25.5

Map Showing Position of Selby Smelter Relative to San Francisco.

cents; shipping expense, 5.1 cents; general expenses, 19.5 cents, the grand total for all operating costs being $2.438 per ton. The railroad freight, together with smelter charges (direct and indirect), amounted to $5.16 per ton of crude ore. The freight ranges from $4 per ton to Tacoma to $8, which is charged to Selby and Denver. On ore and concentrate, as shipped, the total cost of freight and smelting is $19.61 per ton the mill product being, as we have seen, a concentration in the ratio of a little over 4½ into 1.

Such ore and concentrate as is sent to Selby, is transported by rail to Portland, by way of Tekoa, and thence over the Shasta route to Vallejo Junction, where the Selby smelter is situated. The distance from the mill to the smelter is 1150 miles.

Smelting the Ore.

The works of the Selby Smelting & Lead Co. are a mile from Vallejo Junction and 29 miles from San

Francisco; they were founded in 1868 by Thomas Selby, a pioneer hardware merchant of San Francisco. In 1864 Selby built a shot-tower on the corner of First and Howard streets, where it stood until the earthquake-fire. He imported his lead from Spain and England; and finding this both awkward and costly, he conceived the idea of treating the lead ores yielded by the mines of the Pacific Coast, and started to make his own lead in 1868. After his death, in 1875, the business was incorporated, A. J. Ralston becoming president and H. B. Underhill, Jr., secretary, of the Selby Smelting & Lead Co. In 1905 the control was sold to the American Smelters Securities Corporation, and Mr. Underhill became president. The operations of the plant are varied, and the importance of the works may be gauged by the fact that they refine $25,000,000 worth of gold and 12 to 15 million ounces of silver per annum. The smelter gets a variety of products from different localities, but its chief supply consists of the argentiferous lead ore from Idaho and the silicious gold-silver ores of Nevada. The Bunker Hill & Sullivan mine sends crude ore, 'bull-jig' concentrate, fine concentrate, and slime. The last of these has to be briquetted before being smelted, so it is first mixed with fine roasted ore and silicious material (from Tonopah or Goldfield); slaked lime is used as a binder, the briquetting being done in a Boyd press. The bricks from this machine, after drying, are ready for the blast-furnace.

Since the ore supply at Selby is usually irregular and the material smelted rather high-grade, it is not expedient to carry large stocks or to form bedding-floors. From the bins the ore and concentrates are taken to the feed-floor, where they are shoveled by hand into the blast-furnace. This is 36 by 144 in. at the tuyeres. The blast is under a pressure of 33 to 34 oz. per square inch. From 130 to 140 tons of charge is treated per day, exclusive of fuel and slag. Of the charge 60 to 70% is ore. It is aimed to have 15% of lead on the charge. The Bunker Hill product usually constitutes about one-sixth to one-seventh of the whole, the other lead in the charge coming from roasted matte and refinery by-products. The charge consists of:

Lb.	Description and Source.
2,500	Briquetted slime (Bunker Hill), fine iron and silicious ore.
1,100	Roasted matte.
1,000	Limestone (Santa Cruz).
800	Silicious ore (Tonopah or Goldfield).
800	Lead ore, as 'bull' jig concentrate or crude ore (Bunker Hill).
300	Refinery by-products, mainly litharge.
200	Metallic iron (San Francisco).
1,000	Coke (Australia).

This makes 7700 lb. altogether, to which 20% of old slag is added, making 9250 to 9500 pounds.

The roasted matte contains 12% lead, 12% copper, 45% iron, 3% zinc, and 7% sulphur. The slag is returned mainly in order to regulate the physical condition of the furnace and to correct irregularities in its operation. It is the aim to make a slag of the following composition:

%		%	
31	SiO_2	18.5	CaO
35	FeO	7	Al_2O_3

The alumina comes in the silicious ores from Nevada. The slag also contains 1.5% MgO from the limestone, 1% Pb, 1 to 1.5% S, and 2.5% Zn, besides traces of copper, antimony, phosphorus, etc., in fact, minute traces of most of the elements.

The limestone is the reject from the portland cement works at Santa Cruz. The fuel is coke, usually from Australia, coming from Newcastle, in New South Wales; but coke from Alabama and Utah also is used at Selby. The silicious ore is the rich stuff mined at Goldfield and Tonopah, in Nevada. On the day of my last visit to the Selby smelter, they were sampling a carload of ore from the Little Florence lease. This ore contained 15 to 25 oz. gold per ton and in hand specimens the dull yellow streak of very fine gold could be seen traversing the dark flinty quartz. Such stuff requires most careful sampling; the shipment is sampled by hand, one shovelful going to the sample, the next to the reject. The iron required to make a fusible slag is provided by scrap bought from junk-dealers in San Francisco. This scrap iron is bought for $9 per ton and it includes heterogeneous remnants of a curious kind, gathered from the ruins of the great conflagration that almost destroyed San Francisco in April 1906. In the strange assortment sold as flux to the Selby smelter are sewing machines, type-writers, old rifles, stoves, girders, electric motors, bolts, cables, spikes, frying pans, chains, pipe fittings, every form of iron likely to be used in a big city. I saw a whole stack of frying pans melted together by the fierce fire that followed the earthquake; there were lumps of agglomerated spikes, and chains that had lost their shape. The smelter will buy nothing longer than six feet, so any cable, channel iron, or the like, has to be cut before shipment to Selby. It would fall cross-wise in the furnace and prevent the charge from settling properly. Among the scrap piled in the smelter yard there were pieces of structural material such as channel iron and girders, and I noticed that in many cases the iron was melted with pieces of masonry so that they formed an artificial iron ore. Thus the ruins of San Francisco are used in the making of the lead from which the paint on the battleships is fabricated.

When once in the blast-furnace, the charge takes six hours to be smelted. The separation of lead from the matte and slag takes place within the furnace, the lead being drawn off through the Ahrents syphon-tap. The matte and slag run out into a rectangular settler or fore-hearth, which is on a truck, so that the slag being lighter overflows into the slag-pots, each of which holds two tons and is drawn to the water-front by a small locomotive, to be discharged into the Bay.

The matte is tapped from a lower level (of the fore-hearth) into a series of pans on trucks; after cooling, the matte is broken by sledge-hammers, then crushed, roasted, and returned to form part of a subsequent charge. When the copper accumulates in the matte beyond 16%, a further concentration is

effected by smelting a charge of matte, silicious ore, and limestone, so as to get a product containing from 45 to 55% copper. This is first roasted and then leached with the sulphuric acid liquor from the parting-room, the result being to make a bluestone (copper sulphate), which is sold to wheat-growers to kill 'rust' and to the Western Union Telegraph Co. for use in gravity cells. Some of the bluestone goes to Mexico to be employed as a chemical in the old patio process.

The Selby Smelter and National Lead Works.

The matte and the pyritic ores are roasted in Ropp furnaces, the invention of the former superintendent, Alfred Von Der Ropp, a Russian nobleman, now residing at Geneva, and as well known for his long and skillful management of this smelting establishment as he is affectionately remembered for his unfailing humor and courtesy. There are four of these roasting furnaces; three of them are 90 ft. long, and one of them is 150 ft. They are provided with a traveling mechanical rabble, operated by a cable that passes over a sheave at the upper end of the furnace, so that the rabble is outside of the furnace half the time, during which it is being cooled. This is one of the occasions when a nobleman got the best of the rabble.

Returning to the blast-furnace: the lead flows from the well into moulds and is cast into bars weighing 100 lb. apiece. These are taken on trucks to the refinery and there elevated to the upper floor.

Here are the liquating kettles. Liquation or eliquation is the process of separating metals by the difference in their melting points. The lead from the blast-furnace contains copper, antimony, and other metals, the presence of which interferes with its industrial utility; hence the necessity for liquation. There are four kettles for this purpose, arranged in pairs, each pair holding 60 tons. The impure lead is melted at a minimum temperature, about 710°F; at that temperature the copper comes to the surface in the form of dross, which also holds some antimony. A press is hung from a crane into the molten metal within the kettle and the dross is skimmed into this press, where, under a compression of 90 lb. per sq. in., the free lead flows back into the kettle, while the coppery dross (containing some antimony) remains. After 10 or 12 hours the dross will have been skimmed and the lead, now free from all but a trace of copper, is syphoned into a reverberatory called a 'softener,' where the temperature is raised and the remaining antimony driven off by volatilization and oxidation, chiefly the latter. The result of this operation is to put the antimony into the litharge that is skimmed from the surface of the molten lead; these skimmings are run through another smaller reverberatory with a charge of coke and galena and some of the copper dross from the liquating kettles; the result is a yield of copper matte and base bullion containing some of the antimony, the major part of which is collected in a slag assaying 35 to 40% antimony and 62 to 58% lead. This slag is re-smelted so as to yield an antimonial metal, which is sold to the Mixed Metals Co. at Omaha and elsewhere, to be used in making type metal, solder, babbitt, and other

In the Refinery. Reverberatory Furnace, Moulding-Kettle, and Moulds.

alloys of which antimony is a necessary constituent.

When the charge in the softening furnace is 'cooked,' that is, all the antimony, arsenic, and other impurities eliminated, the lead is tapped into desilverizing kettles, 3 ft. deep and 10 ft. diam. There are four of these and they hold 60 to 65 tons each. They are made of cast iron and are fired by oil (as are the other furnaces and kettles in the refinery building) brought from Bakersfield, California. The oil is pumped from the Union Oil Co.'s works, 1¼ miles away, to the tanks at the smelter. This oil is pumped from Bakersfield to the oil works, a distance of 300 miles. When you pass the Selby smelter as a passenger on the overland train and notice a most disagreeable sulphurous smell, don't blame the furnaces in the works you are passing, debit your discomfort to the oil refinery which is to windward (for the wind usually blows from the west) and so happens to reach the traveler just when the train is alongside the smelter. Blame Rockefeller, not Guggenheim. And, on second thought, don't blame even Rockefeller, for he has enough to his charge, including a $29,000,000 fine, for the Union Oil Co. is the one genuine competitor of the Standard Oil.

In the desilverizing-kettles, the temperature is raised to a point where a slab of zinc melts readily in the liquid lead; this is at 840°F. The zinc unites with, and collects, the silver. This is the old Parkes process. Sufficient zinc is added to desilverize the lead and as the zinc melts it is mixed, by a mechanical stirrer, into the bath of lead. The scum of zinc that begins to rise to the surface contains the silver, and gold also, which desert the lead for the zinc. It is a concentrating process. The lead as delivered into the kettle will contain 255 oz. silver and 15 oz. gold; the zinc scum, after being pressed, carries 3000 to 3500 oz. doré, this last being the smelterman's term for the two precious metals when mixed in unrefined bar. Literally, it means golden. Any copper remaining over from the preceding treatment is also collected in this zinc scum. The scum is squeezed in a Howard press so as to extract any uncombined lead. The pressing machine is lowered by a crane into the metal bath and when the press has acquired the temperature of the lead, the scum is ladled into the press. Formerly it was the practice to remove the scum and liquate it, but this has been obviated by the introduction of the press, which was invented by W. H. Howard, formerly at Pueblo and now at the Garfield smelter, in Utah. After being pressed, the scum contains 22 to 24% zinc, 10% precious metals, 3% copper, the rest being lead. The scum looks like the native silver, slightly tarnished, to be seen in mines, as in the Mollie Gibson at Aspen. The molten lead in the kettle resembles mercury, though it is less mirror-like and of lighter lustre. The final scum on the surface of the lead is collected by a wooden rake (which chars, but does not burn) and is lifted out by a flat ladle.

The lead is now free from gold and silver, but still contains some zinc, say 0.5%; it is syphoned to a reverberatory furnace on the ground-floor. This syphoning of molten metal is interesting. It is done by means of a 2½-in. iron pipe bent into U shape with one leg longer than the other. This bent pipe is laid in the bath of lead (within the desilverizing-kettle) until both have the same temperature; then the stop-cock at the lower end is opened and hot lead fills the syphon; the stop-cock is closed; two workmen manipulate the syphon (now full of lead) with tongs and hooked rods so as to get the syphon out of the bath without breaking the column, keeping the end of the short leg within the bath; when the syphon is finally put in place, the stop-cock is opened and the lead runs into the furnace below.

This furnace has a capacity of 70 tons. Here the lead is subjected to an oxidizing heat whereby all the remaining zinc is driven off, partly by volatilization and partly by collection as oxide in the litharge that is formed; this litharge is skimmed and resmelted in the blast-furnace.

Next the lead is tapped into the moulding-kettle, which holds 60 tons, and serves the purpose of maintaining the metal at a suitable temperature while it is being tapped—by a syphon again, but a much smaller one—into 50 moulds, set in three-quarters circle. Each of these moulds yields a pig weighing 100 pounds. As thus refined, the lead is taken to the white lead plant.

But before tracing the conversion of the metal into paint, we must return for a moment to the treatment of the by-products of the refinery. The zinc scum (from the desilverizing process) containing the gold and silver is placed in graphite retorts, to which condensers are fitted. By this process of distillation, the zinc is collected in metallic form, while the precious metals remain in a highly concentrated lead running 4000 to 6000 doré. This rich product goes to the cupelling furnace, where the lead is converted into litharge (which is sent to the blast-furnace), while the doré bar is reserved for the parting-plant. Here the silver is separated by being dissolved in strong sulphuric acid, the resulting silver sulphate being precipitated on copper, leaving a copper-sulphate solution (still containing free acid) that is used for leaching the high-grade matte, as previously related. The liquor from the condensation of the fume escaping from the parting-kettles has a cherry red or ox-blood color due to the presence of selenium, derived from selenides in the Tonopah and Goldfield ores. This gold and silver selenide is converted to a hydrogen selenide and is then reduced by the action of the sulphur dioxide, generated by the solution of the silver in sulphuric acid. The gold remains in the dissolving-kettle as a brown powder; this is washed thoroughly, and then melted in graphite crucibles, to be sent to the mint at San Francisco. The silver, precipitated on the copper, is washed, pressed into cakes, melted in a small reverberatory, and cast into bullion bars. The silver bullion is put in a vault while still hot, as also is the gold. When placed in orderly array within this vault, these beautiful bars of precious metal impress the visitor as tokens of the wealth of Idaho and Nevada, the two contributory States. The silver is sold to the various United States mints, but most of it is exported to Hongkong, for use in China.

We have traced the lead to the last stage of refine-

ment. In an adjacent building some of it is made into sheet-lead, for lining tanks exposed to acid liquors, and in another building at Selby the metal is made into shot of various sizes, put into cartridges, and made ready for those who shoot the ducks and geese so plentiful on the estuary of the Sacramento river and elsewhere in California. The lead is also used in making pipe for sanitary purposes and for

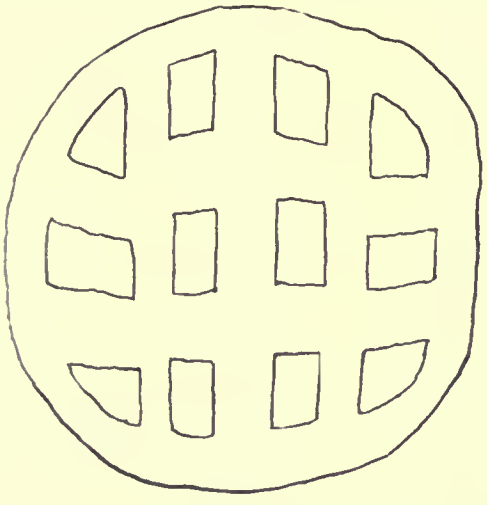


Fig. 4.

encasing underground electric wires. For such purposes it is being used in steadily growing quantities, for it admits of being twisted and bent as iron does not. But our interest at this time is its conversion into white lead to be used as a pigment. This is

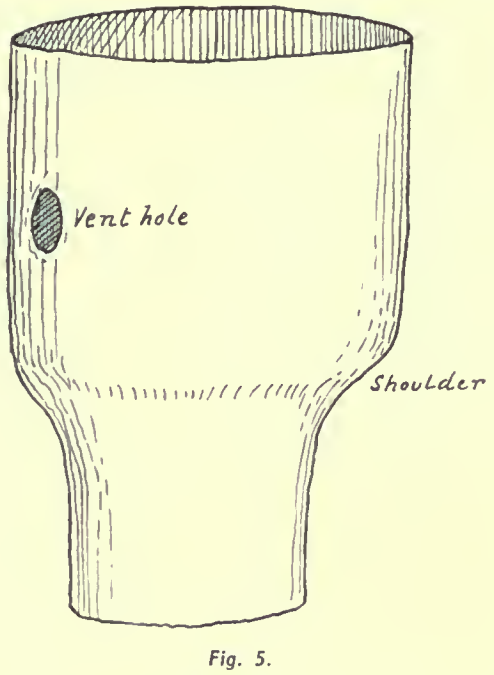


Fig. 5.

done at Selby in a plant alongside the refinery, from which we have seen the lead issue purified of all its other metallic associates.

Conversion of Metallic Lead Into White Lead.

Metallic lead in its purest form is used for making white lead; indeed, in the trade, 'corroding' lead is used as a synonym for purity. White lead results from the corrosion of metallic lead; the process involved is comparable to the rusting of iron, which yields a characteristically red product, just as the similar oxidation of lead gives a white substance. But the conversion of metallic lead into white lead is more than a process of oxidation, it involves both carbonic acid and water, so that it includes carbonization and hydration. White lead is a compound of lead carbonate and hydrated lead oxide, the formula being $Pb(OH)_2.2PbCO_3$. It is valuable as a pigment because it is dead white; any impurity in the original lead or any impurity introduced during the process of corrosion is apt to discolor the product; therefore, the manufacture of this substance demands the greatest care to eliminate every source of contamination prejudicial to a pure white.

The lead comes from the refinery in the form of pigs weighing 100 lb. apiece. The Selby plant manufactures 2500 tons of white lead per annum and this requires about 2100 tons of the 'blue lead,' as the pure metal is termed. Four or five tons of lead are

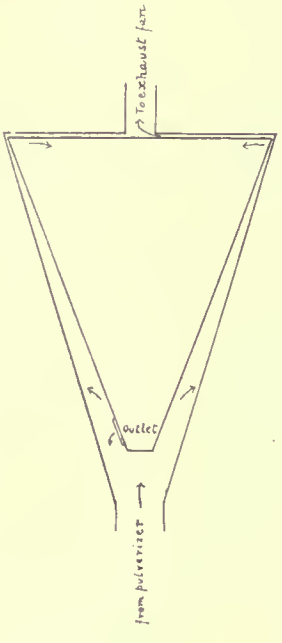


Fig. 6.

melted in a kettle. The molten metal runs out through a divided spout forming a steady double stream; this flows upon an endless chain made of a double series of moulds, each 6 in. wide, resembling waffle irons. The chain is long enough so that when the molten metal reaches the end, the lead has chilled and the perforated discs or 'buckles' fall in a pile ready to be transferred to the 'stacks'. The 'buckle' is a disc of lead $\frac{1}{8}$ in. thick, so perforated as to expose a large surface to chemical action, as shown by the accompanying sketch (Fig 4).

A 'stack' is a series of earthenware pots holding the blue lead while it is being converted into white lead. The pots are arranged in 9 tiers separated by layers of tan, the whole structure occupying a space 20 ft. square, to a height of 20 ft., within a wooden building, arranged in suitable partitions, the sides of which are built up or taken down, board by board, as circumstances require. In the pots the lead is placed so as to be exposed to the corrosive effects of acetic acid. The acetic acid comes from New York; it is made from lime acetate. Wine vinegar might

be obtained in California, of course, but it is too expensive for the purpose. Each pot is (as shown in Fig. 5) 11 in. high, the upper portion being 7 in. diam. and the lower 4½. The pots are made by the Steiger Pottery Co. at Baden, on the southern outskirts of San Francisco. The lower part is filled with acid; the shoulder, formed where the pot widens, carries the buckles, which are thus exposed to the fume without actual contact with the acid itself. If the lead were immersed in the acetic acid, it would be dissolved completely without forming white lead.

In building a 'stack', first a layer, 2 ft. thick, of 'spent tan' is laid down. This is the tan bark discarded from a tannery after all the tannin has been extracted. The tan used at Selby comes from Benicia. On this bed of tan a layer of pots is arranged in 27 rows of 27 each, or 729 altogether. The lower portion—4 in. deep—of each pot is filled with a pint of acetic acid; then the buckles are placed on the shoulder; there are 17 of them, weighing 15 to 18 lb. to each pot. In order to expose a maximum surface to the vapor, the buckles are not laid flat, but are crumpled. On the top of the tier of pots, now filled with lead and acid, separately, the workmen place boards, overlapping so that every crack between any two of them is covered by another board. The purpose is to prevent the tan on the floor above from falling through chinks into the pots of the tier underneath, for this would spoil the white lead. Thus tier after tier is built, the succession of tan, pots, and boards being repeated 9 times. On the top, as on the bottom, a layer of two feet of tan is packed solidly to exclude the air, which if admitted would hinder the regulation of the draft required for slow combustion.

It takes 3 to 4 days to build, and as long to take down, a stack. The treatment requires 100 days of undisturbed chemical action. In the interval, nothing is done save the regulation of the ventilation. Each tier has a ventilating flue, 4 in. square inside and made of redwood. This flue leads to the top of the stack, where there is a valve, so that the temperature may be controlled, just like a furnace, which a stack really is, only on a very low scale of temperature, namely, 170 to 175° F. This temperature is maintained during 100 days and the success of the operation depends upon the maintenance of an equable warmth. If too hot, the acid evaporates rapidly and the lead escapes corrosion; if too cold, the process is too slow and time is wasted. About 50 tons of blue lead is put in each stack and this yields the quantity of white lead indicated by the formula. Of the original lead, 75 to 90% is corroded.

The method in use at the Selby works is the old Dutch process, which has been in use for at least 500 years. Formerly, that is, up to 30 years ago, manure was used, instead of tan. The manure had to be renewed at each operation, but the tan bark is employed repeatedly, only 20% of fresh tan being added each time. When the tan arrives it is red; after use it is black, for it becomes charred. The tan serves as a fuel that has the quality of burning extremely slowly and thus of yielding a low temperature for a lengthened period. The tan ferments when moistened with water; this fermentation is, in effect, combustion, and by it the water is turned into steam, heating the acid and accelerating chemical action. In decomposing—by oxidation—the tan, which is a form of carbon, throws off carbon dioxide. This and the acetic acid vapor produced by the action of the heat on the acid, attack the lead and yield a compound of lead carbonate and hydrated lead oxide, that is, white lead.

The chemical changes are expressed by the following formulas:

1. Lead oxide is formed, thus:

$$Pb+O=PbO$$

2. Hydrated lead oxide is formed:

$$Pb+H_2O+O=Pb(OH)_2$$

3. Lead oxide in presence of acetic acid (abbreviated symbol, $Ac=HC_2H_3O_2$) yields lead acetate and water, thus:

$$PbO+2HAc=PbAc_2+H_2O$$

4. Lead acetate and hydrated lead oxide combine, forming a basic acetate:

$$PbAc_2+Pb(OH)_2=PbAc_2.Pb(OH)_2$$

5. The basic lead acetate, $PbAc_2.2Pb(OH)_2$, reacts with carbonic acid gas in the presence of steam so as to form white lead, $Pb(OH)_2.2PbCO_3$, neutral lead acetate, $PbAc_2$, and water. These reactions cannot be expressed accurately by any known formula.

Thus in the final stage, the interchange of atoms produces the molecules necessary to continue the reaction. This explains why a very small quantity of acetic acid suffices to corrode a relatively large quantity of metallic lead. Only 0.3% acetic acid is needed, that is, 0.3 lb. acid will corrode 100 lb. lead, while if the reaction were a direct conversion from one substance into another there would be required 120 parts of acid to 207 parts of lead. The re-agents necessary in large quantity are CO_2 and H_2O, that is, tan and steam, both being produced from the moistened tan.

For a week or ten days the valves of the flues are kept open so as to create a draft and accelerate the combustion of the tan. Hot steam escapes from the top of the flues and is visible on a cool day. When uncovered the buckles are seen to have been changed from a blue metal to a white earthy substance, and when examined it is seen that the change has proceeded to a varying degree: most of the buckles are corroded thoroughly, while others retain a thin nucleus of metallic lead.

The next operation is to separate the corrode from the uncorroded lead and grind it, to be ready for use as a white paint. When the chemical action in the 'stack' is completed, the top boards and uppermost layer of tan are removed. The pots are picked up by hand and (the acid having all evaporated) their contents are emptied into wheelbarrows, in which they are taken to a hopper, whence a bucket-elevator lifts the white residue to the top of the grinding-mill. The elevator discharges into a large revolving screen, called the 'rumbler', which resembles the trommel used in ore-milling. By the attrition to which it is subjected in this revolving screen, the white corrode is shattered, while the remnants of blue lead that have survived corrosion are flattened. The white

lead goes through four or five of these hexagonal revolving screens of increasing fineness, gradating from ¼-inch apertures to the size of a pin-head, that is, one-fortieth of an inch. Besides the screening, the corrode is subjected to reduction by two pairs of rolls. In this process also the bits of blue lead are flattened and extended, while the white lead becomes subdivided by breaking until it is pulverized. This facilitates the separation of the one product from the other, the blue lead going back into the yard, to be re-melted, and cast into buckles.

Finally, the white lead passes through the finest of the screens, having brass wire-cloth with $^1/_{40}$-in. holes. Brass is used because iron or steel would be rusted by the trace of acetic acid remaining in the corrode, and any rust, of course, would contaminate the white lead, which comes from the last screen looking like corn meal. Next it goes into a cylindrical bin and thence into a pulverizer, the effect of which is to throw the particles against each other so as to break them by the force of collision. On the top of the pulverizer stands an inverted cone, 20 ft. high, the bottom being 2 ft. diam. and the top 15 ft. Inside of this there is a second cone, open at the top and with an outlet at the bottom. The outer cone has a tight cover, the only opening being in the centre, where there is an escape through a pipe attached to a suction fan. (See Fig. 6.) As soon as the particles of white lead are fine enough to be carried in suspension they fly upward and outward between the two cones, which are 18 in. apart at the bottom and only half an inch apart at the top. The white-lead dust has to rise 20 ft. and fly horizontally 7 ft. before it reaches the outlet, in a stream only half an inch deep. If it is not sufficiently pulverized to be able to do thus, it falls back into the pulverizer for further comminution. This method of sizing in air is very different from, and much more effective than, the old way of separation in water. It is the invention of the superintendent of the white lead plant, which is the property of the National Lead Co. of California, while the smelter adjoining belongs to the Smelter Securities Corporation, a subsidiary of the American Smelting & Refining Company.

The fan above the cones is run at such a speed and the pulverizer is so regulated as to give a product that will pass through a silk cloth of 200 mesh or 40,000 apertures per square inch. Such a cloth will hold water for a while, that is the water will not break through until its surface tension is overcome. The silk comes from Grenoble, in France. From the fan the white lead passes to a cyclone collector, which is well named, for the draft makes a cyclone, the dust being blown into the top of a cylindrical tank with a conical bottom, so that the powdered white lead falls at the centre of the whirl, where a quiet eddy abates the centrifugal force. Thus it descends into a storage bin, ready to be packed dry or mixed with oil.

A Cruiser in Dry-dock at Mare Island Receiving a Coat of Paint.

To eliminate the last trace of acetic acid, the air that goes through the fan is first ozonized by being passed through a silent electric discharge of 5000 volts. The ozonized air has a decided smell, as of mountain air or the atmosphere after a thunder-storm. Ozone is a strong oxidizer and destroys any surviving particles of tan or acetate of lead. The excess of air from the pulverizer is laden with dust, that is, minute particles of white lead. To clear it, this dust-laden air is passed through 200 canvas bags, each 8 in. diam. and 40 ft. long, arranged in vertical series. These allow the air to escape through the canvas while retaining the dust, so that an extremely fine product is saved by this operation.

We have now followed the white lead to the bin underneath the cyclone collector. From this bin the product is put into a truck and then shoveled into a mixer, which is a revolving pan having a stirrer on one side. Here the proper quantity of linseed oil is added. The lead and the oil are mixed for 20 to 30

minutes. Then the valve in the centre of the pan is raised and the white lead passes into a receiver; this feeds the stones, where the white lead is ground with oil. The oil is refined linseed oil made from flaxseed grown in Idaho and Washington. The seed is crushed between rolls and then placed under a hydraulic press (6000 lb. per sq. in.), so that the natural oil is squeezed out. It is then refined by filtering and settling. The oil used at Selby is supplied by the Pacific Oil & Lead Co. of San Francisco, a branch of the American Linseed Oil Co. But if the white lead is to be packed dry, it is put into an ordinary flour barrel, which holds 800 lb. of white lead, as compared to 198 lb. of flour.

From the receiver the white lead drops into the eye or centre of a pair of oil-stones. These are French buhr-stones, the lower one revolving, while the upper is stationary, so that the lead has to pass between the two surfaces, which are pressed hard against each other. The white lead works its way to the edge of the stones and drops to the centre of another pair, the rotary motion again causing the product to travel from the centre to the edge, where it falls into a cooler, the white lead in the course of grinding having become warm (about 150°F). This cooler is a water-jacketed fixed brass pan with three revolving arms, which aerate the lead and move it to an outlet leading to a small hopper. The hopper empties into the kegs, as they are placed underneath by an operator. A keg 12 in. high and 10 in. diam. will contain 100 lb. lead in oil. The keg is filled while it is being weighed. White lead is sold in kegs of various sizes holding from 12½ to 300 lb. each. The kegs are made at St. Louis; the wood is oak. For this purpose the Californian oak is unsuitable, being too porous. The bungs are made of poplar, which is soft and does not split. A label is affixed with glue and this moisture causes the bung to expand so as to fill the aperture snugly. The label of the Selby works is in blue and gold, the colors of the University of California.

The plant is run by electricity, there being a separate motor for each part of the process. The current is supplied by the Bay Counties Power Co., from a generating station at Colgate, in Yuba county, 140 miles distant. The transmission of power involves crossing the Straits of Carquinez, a short distance above Selby, where the estuary of the Sacramento is 2750 ft. wide. Two towers carry the line; that on the north side of the Straits is 225 ft. high on a bluff 160 ft. above the water, and the one on the south side near Crockett, is 64 ft. high, at an altitude of 300 ft. The span, from tower to tower, is 4427 ft. long.

The smelting operations are under the direction of E. N. Engelhardt, as manager, with F. C. Newton, as assistant. The superintendent of the white lead plant is J. P. Neville. Thus a Russian, an American, and an Englishman unite in manufacturing the pigment, and just as the various substances required in the making of white lead come from localities widely separated, so the intelligence that applies them usefully is contributed by diverse nationalities.

From Selby the white lead is transported on a barge or steamer to the Navy Yard at Mare Island, which is less than a mile distant. Dry pigment is preferred for use at sea because oil renders it more subject to deterioration. Paint and oil are always placed in 'the eyes of the ship,' that is, the forepeak, right in the bow. Here there is a space that is useless for other purposes; it is fitted with shelves, tanks for linseed oil, and other ingredients. The fire-plug is always put in 'the bows', as a protection. But if the paint is to be used at once, the white lead already mixed with oil is purchased by the Bureau of Supplies & Accounts of the Navy Department, the price being 6 cents per pound. After arrival at the Navy Yard the white lead is mixed according to formula, the first coat contining considerably more lead than the last. This is done because lead is an excellent preservative against the weather and gives a good body for the first coat; if it were used in the final coat without a large proportion of white zinc, the surface of paint would soon acquire a dirty yellow hue. The following are the official specifications for the white lead purchased by the Navy Department.

SPECIFICATIONS FOR WHITE LEAD,

ISSUED BY THE

BUREAU OF SUPPLIES AND ACCOUNTS, NAVY DEPARTMENT,
OCTOBER, 1902.

SUPERSEDING SPECIFICATIONS ISSUED JANUARY, 1901.

Must be of the best quality, finely ground in pure well-settled raw linseed oil; must be of maximum whiteness; must work freely under the brush, and not be crystalline in structure nor deficient in density and opacity; must not contain more than 0.5 per cent of moisture, and as best commercial grades of white lead contain acetates equivalent to less than one-tenth of 1 per cent of glacial acetic acid, under no circumstances will white lead be accepted which contains acetate in excess of fifteen one-hundredths of 1 per cent of glacial acetic acid. Dry pigments must contain at least 98 per cent of hydrate carbonate of lead. Its working under the brush, maximum whiteness, body, and covering qualities to be determined by practical test.

GENERAL PAINT SPECIFICATIONS.

The pigment must be of the best quality, finely ground in pure well-settled linseed oil (unless otherwise specified) to a medium stiff paste which will break up readily in thinning, and must be free from barytes or other adulterants. The shade, fineness, and tone must in each case be in strict accordance with samples to be seen upon application to the general storekeeper.

Packing.—In all cases where paints, etc., are purchased in *metal* packages they are to be boxed in quantities of 100 pounds each; the cases to be made of ⅞-inch new pine, planed on the outside. Tin pails or cans (commercial packages) of 12½, 25, and 50 pounds are to be provided with bails.

It may be mentioned that each vessel has a certain allowance of paint given her every six months. The flanges of piping for steam, exhaust, ventilation, fresh water, and salt water, etc., all have to be painted with different colors, for easy identification. To suggest the quantity of lead consumed, it may be stated that an ordinary 30-ft. racing cutter, if painted for service, would require 150 lb. of paint. Just previous to a race, every particle of this is scraped from the boat, thus removing what would be equal to the weight of an extra man.

Zinc white is mixed with the lead as a preservative. Zinc white, or zinc oxide, is obtained by a process, the essentials of which were worked out by Samuel Wetherill in 1851; this consists in mixing the roasted ore with fuel (anthracite or coke), and bedding it 3 or 4 ft. thick upon a hearth made of perforated cast-iron plates. The furnace door is closed and cold air blown under the grate. The zinc is volatilized as metal, but immediately oxidizes to a fume, which is collected from the smoke by passing it through muslin bags. The fume so collected requires to be subsequently refined. Zinc white of pure grade is also made in one operation by distilling metallic zinc, or commercial spelter, placed in fire-clay retorts on the hearth of a reverberatory furnace, the light flaky oxide being readily carried off in the draft, and caught in collecting chambers of large dimensions. Another method, employed in France, is to expose metallic zinc to the action of superheated steam. Zinc oxide is formed, with the evolution of hydrogen, which may be mixed with carburetted gases to form an illuminating gas of high heating power. The great advantage of zinc white over white lead is that sulphur gases in the atmosphere will not discolor it, whereas with white lead a black lead sulphide is formed.

The drying of paints, varnishes, and oils means the oxidation of the medium with which they are mixed by means of some substance that will readily yield up oxygen, such as lead oxide (litharge) or manganese dioxide. Boiled linseed oil is commonly employed for this purpose, it having been boiled with one or the other of the above-named substances, whereby a portion of the oil is oxidized, and an amount of the oxidizing agent is dissolved and slowly continues the reaction in the oil. The effect of oxidation of the oil is to convert it into a permanent leathery material, which resists the action of the weather. It is this behavoir of linseed oil in the presence of a 'drier' or oxidizer that makes it suitable as a medium for spreading pigments upon wood and iron. Turpentine

Photograph by Turrill & Miller.

The Cruiser California in the Bay of San Francisco.

also oxidizes readily, and does not dissolve mineral substances, nor react with them chemically, but it is a solvent for the leathery product of oxidation of boiled linseed oil, and it also mixes with the oil, which it will not do with water or most liquids. Hence it is useful as a 'thinner' for paints, without impairing their quality, or checking their rate of drying.

The following are the instructions issued by the Navy Department relative to the painting of vessels:

INSTRUCTIONS RELATIVE TO PAINTING NAVAL VESSELS.

1. The quantity of the different paint materials given in the allowance is calculated on the number of square yards of surface to be painted and the number of coats to be applied. The number of square yards of painting surface for different paints is to be inserted in table at the time of the preparation of the allowance.

2. The quantity of oil and turpentine sufficient to mix a given amount of paint varies. If the paint is newly manufactured it will require less, and if there be a high temperature it will also require less, but the quantities given in the formulas may be considered a fair proportion, and such as will insure good drying.

3. Paint should be used as soon as it is mixed, and therefore should not be prepared in larger quantities than may be required for the work in hand. The drying qualities of all paints are injured if kept mixed in store-rooms for any considerable time. Surplus mixed paint should be carefully protected from the air, and used on the first opportunity, with a little turpentine added.

4. The surface of the work to be painted should be thoroughly cleaned and dry before the paint is applied.

5. Brushes after being used should be rubbed out and immediately placed in water and kept there until required again.

6. In painting all pipes aboard the vessel, the standard colors for piping as issued by the Bureau is to be adhered to for the different piping systems.

7. In the preparation of the allowance list of paints, additional colors and paints will be allowed for the painting of such articles and fixtures as would not be coated by any of the formulas hereafter given.

WHITE PAINT FOR OUTSIDE WORK.

Formula for mixing 1 gallon.

No. 1.

White lead in oil	pounds	7
White zinc in oil	pounds	7
Raw linseed oil	gallon	½
Turpentine	gills	2
Japan drier	gill	1

No. 2.

White lead in oil	pounds	5
White zinc in oil	pounds	9
Raw linseed oil	pints	3
Turpentine	gills	4
Japan drier	gill	1

This paint is to be applied to all work exposed to the weather, including outside of hull from load water line to rail; inside of waist; under break of forecastle and poop decks; and on the inside and outside of boats.

When the paint is in such condition as to require two coats, formula No. 1, as given above, should be used for the first coat, and formula No. 2 for the second coat. When only one coat is required, formula No. 2 should be used.

WHITE PAINT FOR INSIDE WORK.

Formula for mixing 1 gallon.

White lead in oil	pounds	7
White zinc in oil	pounds	7
Raw linseed oil	gallon	¼
Turpentine	gallon	¼
Japan drier	gill	1

This paint is used for painting crew's spaces, store-rooms, magazines, and dynamo-rooms, inside pilot-house, etc.

If old work is in good condition one coat is sufficient; if in bad, two coats should be applied.

FLAT WHITE

Formula for mixing 1 gallon.

No. 1.—For officers' quarters (white).

French white zinc	pounds	8
White lead	pounds	9
Turpentine	pints	3
Raw linseed oil	gill	1
Japan drier	gill	½

No. 2.—For officers' quarters (flat white).

French zinc	pounds	17
Turpentine	pints	3
Japan drier	gill	½

When the paint is in bad condition, having turned yellow or worn with age, it should be given one coat of white paint as per formula No. 1, then one coat as per formula No. 2 (flat white). If the work is in fair condition and only requires one coat of paint, formula No. 2 (flat white) should always be used. Formula No. 2 should be mixed as above in the afternoon, run through a seive to get out all lumps, skins, etc., top of vessel covered and placed aside until next morning, when all oil or liquid found floating on top of paint should be dipped off. If the paint should be found too thick, after stirring, to work free and spread well under the brush, a small quantity of clear spirits of turpentine should be added.

The quantity of different paints required to cover 100 square yards of surface one coat is as follows:

Weather work, white	gallons	3¼
Inside work, white	gallons	2½
Flat white	gallons	1¾

And thus finally we have followed the white lead from the ore broken in the mine in northern Idaho to the Navy Yard at Mare Island, where it is laid upon the sides of the battleship. But one more agent is necessary to finish this highly complex technical process; that agent is the sunlight of California. Navy men will tell you that the painting of vessels in the ports of Puget Sound is hindered by the dampness of the climate and that the sulphurous smoke of other localities will blacken the fresh paint. At Mare Island the painting proceeds under most favorable conditions, for the air is pure and sunny, so that the paint dries without hindrance. Thus many lands and many States contributed to the manufacture of the paint that not only decorates the battleship but also preserves its steel structure from the corrosive effects of wind and weather. We have seen that some one ingredient or device has come from France, Australia, New York, Missouri, Alabama, Washington, Idaho, Nevada, and California, but the final touch was given by the warm pure sunlight of California.

A simple calorimeter has been constructed by Charles Féry for determining the calorific power of gases and liquids. The combustion is effected at the base of a glass chimney, the top of which supports a nickel plate pierced with a number of holes. The air necessary for combustion passes down a similar chimney, which is connected at its base with the former. The two junctions of a constantan-copper thermo-circuit are placed at the tops of the chimneys, and the electromotive force in the circuit is exactly proportional to the calorific power of the combustible and to the volume consumed in unit time.

Concentrates.

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

Box-rise is a name given in Western Australia to a timbered raise. Such raises are by law required to be timbered, regardless of the character of the ground, when they are steeper than 30° and higher than 30 feet.

Lubricating oil that low temperatures will not cause to thicken, may be made, according to Paul S. Baker, by mixing graphite with cylinder oil until it is of the consistence of paste, and then thinning up with kerosene until it will flow. This is said to remain fluid even at temperatures as low as 14° below zero.

Magnesite is a carbonate of magnesium resembling unglazed porcelain, being fine-grained and white. It has recently been introduced as a bleaching agent in the manufacture of paper from wood pulp, for which purpose it is said to be better and cheaper than chlorine. Tulare county, California, furnishes most of the magnesite used in this country.

Talc depends for its commercial value largely on its freedom from iron. The fibrous talc of Lawrence county, New York, is worth about $8.50 per short ton at tide-water. The best foreign varieties are worth $20 to $35 per ton. In Virginia the soapstone industry has assumed large proportions, the product being sold at $20 per ton. Pyrite often occurs in talc, but this will render it valueless, as it must be white for use in paper-making and similar industries.

Stockwork is an old name for a type of ore deposit which differs from well-defined veins in a complete absence of walls, and in presenting a more or less uniform decrease in metallic content from a central zone of relatively high enrichment outwardly on both sides into the country rock. It is most commonly seen in the cases of copper, tin, and lead deposits. The term has been erroneously employed in recent years throughout the Southwest to designate net-works of veinlets such as occur in some of the Nevada gold camps.

Emery is the trade name for an impure variety of corundum, containing iron as ferrous oxide (FeO), which imparts to it a dark color, usually grayish. Its hardness is slightly inferior to corundum, which fits it for certain uses where corundum would be less desirable. The name is wrongly applied at times to corundum from which the heavy iron minerals have not been separated in concentration. The largest deposits of emery are on the island of Naxos, in the Grecian archipelago, where it occurs in large masses, not requiring to be concentrated.

Fluorspar is of especial value in conjunction with fluxes for thinning the slags in the manufacture of steel, particularly in the open-hearth process. It is also employed for a like purpose in foundry practice. The higher grades, namely, the pure white or pale blue, are used in the manufacture of agate-ware and opalescent or milky glass. Western Kentucky and southern Illinois lead as domestic producers of fluorspar. The average prices for the American product f.o.b St. Louis are: ground, $9.93; lump, $5.64; and 'gravel,' $4.16.

Fuller's earth is used in clarifying oils and fats. It must be finely divided and free from such abrasive matter as might increase the wear of pump cylinders, pistons, and valves, and it must contain as much bleaching substance as is consistent with rapid filtration. It is observed that when the alumina exceeds one-fifth of the amount of the silica present the critical point is nearly reached, beyond which an increase in the densely bedding aluminous matter retards filtration, as the silica serves to maintain porosity. In the bleaching of cotton-seed oils, lards, and other organic oils or fats required for cooking, the presence of matter giving foreign flavors or odors constitutes a fatal objection. The value of ground fuller's earth is $14 to $17 per short ton.

Sulphur in coal occurs in three forms, namely, organic sulphur, which is held in some manner not perfectly understood; pyrite, either as 'scale,' that is, thin films on the joint-planes of the coal, or associated with layers of aluminous material, or in nodules called 'sulphur balls'; and, finally, as gypsum (lime sulphate), also occurring on the joint-planes, that is, the planes running at right angles to the bedding-planes of the coal vein. For coke-making low sulphur content is necessary, if the coke is to be used for smelting iron. In copper and lead smelting moderate amounts of sulphur in the coke do not introduce metallurgical difficulties, but increase the costs in various ways. Pyrite and the slaty impurities in coal may be removed by washing to a certain extent, and thus adapt a 'dirty' coal to the production of good coke.

Furnace temperatures may be measured without elaborate appliances and with great accuracy by means of Seger cones. These are slender cones several inches high, molded from some refractory material, such as clay, mixed with other substances in such proportions that cones having different melting points are obtained. A measurement of the high temperature is made by placing a number of the cones, having graduated melting points, in the furnace or kiln. Some of the cones may melt down, while others are unaffected. The one which shows incipient fusion will register very close to the temperature of the furnace. Pyrometers of various types are much used in high-temperature measurements, the thermo-electric pyrometer being, perhaps, the most popular in the United States. This instrument is based upon the principle of the thermo-electric couple. In it two dissimilar metallic conductors are joined and connected in electric circuit with a galvanometer. The couple is inserted into the furnace when an electric current is generated which produces a deflection of the galvanometer needle, the amount of which deflection depends on the temperature.

ADVICE TO MINING STUDENTS.

By J. H. Collins.

*It has been said that a student taking up practical work should put aside all he has learnt. This is not so; what he has learnt must be continually in use to interpret what he is learning, but he must from the first recognize the essential difference between laboratory and factory work. In a laboratory, accurate knowledge is essential, while the actual cost of operations in time and material is not considered for a moment. For instance, days of time and pounds in money are often spent to obtain a microscopic button of gold, which when weighed or measured is in many cases thrown away. In practical work, how different is the procedure! The man who can extract three-pence worth of gold at a cost of one penny is more valued and rightly so, than he who extracts six pence worth at the cost of a shilling. It is evident then that one of the very first things to be considered in practical work is the cost of the operations—cheapening of methods in time, material, and labor must be the constant effort of the operator, who as such has failed until he has produced something at a profit.

To show how important it is that you should view life as a school, I propose briefly to remind you how greatly our professional field has been extended within the experience of men now living and in active employment. Important new mining fields have been discovered and opened up in Europe, Asia, Africa, Australia, and America, while those already known have, with a few exceptions, continued to produce largely. The diamonds of Kimberley, the gold of Mysore, the Transvaal, Rhodesia, Queensland, West Australia, the Klondike, and many other regions are mostly new factors, while the demonetization of silver, even more than its increased production as a by-product, has so lowered its value that it can now hardly be accounted one of the precious metals. The supplies of lead and zinc, of copper and tin, have hitherto been sufficient to meet the enormously increased consumption without serious inconvenience, though the prices have fluctuated greatly. But the great supplies of alluvial tin from the East Indies, the enormous quantities of tin ore quarried in the Tasmanian stock-works, the considerable supplies from New South Wales, and the large and increasing shipments from Bolivia are all being readily absorbed, so that it really seems as if there must be a tin famine in the not distant future unless—which is hardly to be expected—there should be some substitute found for use in place of tin-plate.

But the United Kingdom is no longer the centre of production for these metals, as it was in not very distant times; production has been shifted to remote regions, though fortunately many of those regions are still within the British Empire. How great the shift has been in the cases of tin and copper is shown by the following figures. Half a century ago, the world's production of copper was estimated to be somewhere about 40,000 tons per annum, of which the west of England yielded rather more than one-third. Last year the world's production had increased to over 700,000 tons, but the west of England production had fallen to about 400 tons. In the year 1870, the world's production of tin was estimated at 20,000 tons, of which the west of England yielded about half. Last year the total production was 97,000 tons, of which the west of England only yielded something under 5000 tons. The production of coal and iron-ore has now reached enormous dimensions, and here too we no longer take the lead as we did for so long a time. And in addition to the mining of coal and the metals there has been a steadily growing production of such minerals as bauxite, kaolin, asbestos, barytes, lime phosphate, salt, etc., necessitating in some cases ingenious modifications of former methods of working.

In prospecting coal-beds, as also certain types of ore deposits, the diamond and calyx drills have been of the greatest service, and of late many ingenious contrivances for detecting deviations in the bore-holes themselves have been much in evidence. River dredging for gold and other minerals has been successfully carried out in many regions. Steam-shovels and other mechanical appliances have been employed successfully in open-cuts. In shaft-sinking in loose ground, the ingenious Poetsch freezing system has been of great value in several instances. As to the methods employed for breaking the ground, the chief changes have resulted from the use of machine-drills and high explosives. In 1868, I first saw Doering's machine-drill at work in Tincroft mine in Cornwall. It was not a success, for, being operated by steam, the workings were rendered almost unbearably hot: in fact, as long as steam was the motive power, the use of the machine-drill underground made very little progress either at home or abroad, and it is certain that if compressed air had not been introduced, boring machines would today play a small part in mining or tunneling. Once introduced, however, the immense value of the system for hard ground was fully recognized. For ground that can be driven for £6 per fathom or less there is even now little or no advantage in using machine-drills where even moderately skilled miners can be obtained, and the same may be said of stoping in other than very hard ground. For instance, six men at Wheal Kitty in St. Agnes have quite recently driven a full-sized cross-cut in fairly hard ground at the rate of 4 ft. per day. On the other hand, where ground is really hard, the saving of time and even of actual cost is often very great. We have no longer to drive adits as formerly at Hey Tor at £60 per fathom, or to sink shafts, as at North Roskear, at £1 per inch. Rock-drills and high explosives have changed all that. A further good effect of their employment has been the enlargement of the main drifts which together with cheap steel rails, has led to much improved underground transit. Ventilation also has been especially aided by the large amount of cool exhaust air set free by the machines. The greater number of machine-drills hitherto have been employed in sinking, raising, or driving, but there is a growing tendency to employ them in stoping also where the lodes or

*The Le Neve Foster lecture delivered to the students of the Royal School of Mines on March 19, 1908. Contributed by courtesy of the lecturer.

pay-streaks are sufficiently wide. Much improvement has shown itself in the planning of shafts; they are now usually rectangular rather than square, round, or oval, and either vertical or following the mean dip of the ore at a definite angle, without changes of direction or underlie.

Forty years ago much gunpowder was still used in the mines; today after many experiments with compressed powder, cotton-powder, and other such compounds, and after nitro-glycerine has been tried and given up because of its danger, such high explosives as dynamite, gelignite, and the like are almost universally used. They have not only become indispensable for breaking the ground, but they are also found to be much safer in use than the old black powder.

Great improvements have been effected in the machines used for compressing the air employed in using the machine-drills; compound engines, compressing the air in successive stages are now generally employed in the larger mines. Machine-drills operated by electricity have been tried in many places, but so far they can hardly be said to have held their own against the air-driven drills.

There have been great improvements in the engines used for winding during the past few years. It no longer takes 30 minutes or more to raise a kibble of stuff from the bottom of the deeper mines as it did within my remembrance; skips running between guides are now common; cages bringing the ore-wagons direct to the surface are employed in many mines; the men are commonly brought up from below in shaft-gigs or special skips, so that the man-engine, once so great a boon and so common in Cornwall, can now only be seen, so far as I know, in operation in the Levant mine. For modern winding, wire ropes are universally used, and are practically indispensable. Accidents from its use are indeed exceedingly rare. Mr. Morgan's traversing engine erected some years ago for hoisting from Williams's shaft at Dolcoath will soon be at work again, but so far no proposals seem to have been made for using this remarkable engine anywhere else. So numerous have been the problems connected with winding from deep mines that two volumes of the Transactions of the Institution of Mining and Metallurgy have been devoted to this subject alone. For signaling in shafts, the old 'knocker line' is still in use and has its advantages. Indicators for the guidance of the engine-man are, of course, placed in the engine-house in every case where men are raised, and in most other cases; over-winding is an extremely rare occurrence, such is the carefulness of the engine-men. The telephone was introduced in Wheal Eliza in Cornwall by Le Neve Foster many years ago for signaling from below, but it did not 'catch on.' However, it is used in many foreign mines for this purpose.

As yet, the deep mines of Cornwall as also those yielding really large quantities of water abroad — have been drained by a series of plunger and drawing lifts attached to set-offs from a vertically reciprocating and well balanced main-rod. And in most cases these are operated by the Cornish engine, which is a simple single-acting vertical condensing beam-engine, the expansion of the steam taking place within the cylinder. This combination is known as the Cornish pumping system, and no other system should have the name Cornish attached to it. In a few instances, a compound horizontal engine has been employed to work the main rod through angle-bobs with good effect as at the Basset Mines in Cornwall, and in several collieries in the north of England. Of late many attempts have been made to introduce centrifugal pumps operated by electricity for draining the mines and these have been successful in several large collieries. A certain measure of success too has attended these efforts at the Tywarnhaile mine in Cornwall, but it must be admitted that up to the present the system has made no notable progress in that region, though there have been several disastrous failures. I do not doubt that in the end electrically-driven pumps may reach success, even in vein-mining, but there are many difficulties to be overcome that the electrical engineers do not seem to have sufficiently considered. It is not so much the volume of water that calls for such serious consideration, nor even the depth from which much of it has to be raised, but the fact that the water comes in variable quantities and at varying depths; that it is often muddy, gritty, or corrosive. Often the pumps are liable to floodings and yet they must be fixtures capable of being started up to work after an interval while still under water. All these conditions are successfully met by the Cornish system. It must be admitted that so far they have not been met by any other system except at very great cost both in installation and working.

The steam boilers used in Cornwall are still mostly of the Cornish or Lancashire type, and work at comparatively low pressures. The number of these boilers working above 60 lb. per inch is not very great, and those working at 100 lb. or more could almost be counted on the fingers. But in foreign mines, multitubular boilers, portable or semi-portable, are used in a great many instances, particularly for winding, while a growing number of plants are worked by engines which consume 'suction gas.'

Many improvements have been introduced in the treatment of ores when they reach the surface. The first crushing is usually done by stone-breakers of the Blake or the gyratory type, followed in the case of gold, silver, and tin, by stamps of the Cornish, Colorado, California, or pneumatic type, the 'rows' being finally reduced by some form of fine pulverizer. At Dolcoath mine, powerful batteries of three types of stamps can be seen regularly at work on similar ore, and almost side by side. As regards economy, there does not seem to be much difference, but the preference is gradually given to the pneumatic stamp. Mechanical feeders have not yet been applied to the Cornish or Colorado stamps, but they are always employed for the California and the pneumatic stamps. Ores of copper, lead, and blende, after the first rough crushing, are usually further reduced by rolls or by Chilean mills, and then jigged. The finer sizes are dealt with pretty much as tin ores, only less elaborately. In dressing the crushed tin-ore, while buddles are still used at some stages, shaking tables of

the Wilfley or Buss type are extensively employed in many mines; in others, Frue or Luhrig vanners; hydraulic separators are mostly used to remove the slime before feeding the pulp to the tables, but in the case of the vanners, the slime is generally removed for separate treatment at a later stage. For the slime treatment of ores of tin, lead, copper, blende, etc., there is still nothing known that has proved itself better than the dead-frame, the ordinary round slime-table, or the Acme table. The old fashioned swinging rack for cleaning slime has practically disappeared, though it had some notable merits. There is still much room for improvement here, for it is not always possible, and it is always costly and inconvenient, to install a slime plant by the acre in a large tin mine, and less than that does not suffice even to recover a moiety of the valuable metal in the tailing.

Many forms of ore-treatment are on the borderline between mining and metallurgy, as, for instance, the chlorination and cyanidation of ores of gold and silver, and the wet-extraction methods for copper. In gold recovery, the general substitution of cyanide treatment for amalgamation, and the extensive introduction of the improved filter-press has, in great degree, removed the ancient dread of sliming; in fact, this is now directly aimed at in many mines, so that the modern tube-mill becomes more and more applicable every day.

Most tin-ores need calcination before they can be cleaned for market. In many of the smaller mines, the old reverberatory oven is still in use, but in the larger mines, the Brunton revolving calciner is always employed and is very satisfactory in its working. The calcination of tin-ores produces in some mines large quantities of 'arsenic soot' which, at one time valueless or worse, is now an important by-product. In Cornwall it is handled by the ton as freely as sand, and apparently with equal impunity.

An important by-product in some tin mines is wolfram, which at one time was merely regarded as a deleterious component of the dressed tin, but is now profitably extracted, in particular at Clitters United, East Pool, and South Crofty, by means of the Wetherill magnetic separator. In this machine, the powdered and thoroughly dried concentrate is carried slowly over electro-magnets on traversing belts. The magnets remove the slightly magnetic particles of wolfram, while the non-magnetic particles of cassiterite pass on and fall into a separate receptacle. The wolfram so separated in most cases still contains a considerable percentage of tin oxide. At the mines mentioned, this tin-wolfram product is 'pickled' with dilute acid (aided by jets of steam at East Pool) in order to remove certain highly magnetic iron oxide components which seriously interfere with the operation of the magnetic separator. A similar 'pickling' has long been recommended, and occasionally used on a commercial scale for the removal of copper from calcined tin ores.

The use of electricity is spreading in the Cornish mines, apart from the attempts to use it in pumping; at East Pool it has long been employed for surface traction, the mill being a mile or more away from the mine. At South Crofty, it is employed for operating the ore-breakers and the new stamp-mill, and the dressing plant generally; in several other mines it supplies power to work pulverizers, buddles, and other dressing machines, and in this direction, as also in electric lighting, there is a large field for extension.

At Tywarnhaile, and also at Dolcoath, the Elmore oil processes have been introduced for the concentration of low-grade copper ores. The wet pulp is mixed with oil and subjected to a partial vacuum by which means the ore-particles are floated up from the waste as a sort of mineral scum with much less loss than is the case by the method hitherto employed. Other flotation processes for saving zinc have been tested on a considerable scale in various parts of the world, but I do not know whether any of them can be said to have proved decidedly successful from a commercial point of view up to the present.

If the extensions of the mining field have been so great, those of metallurgy proper have been no less so. The enormous enlargements of the reverberatory and blast-furnaces, the many excellent mechanical roasting furnaces, the application of the Bessemer process in pyritic smelting and copper production brought about by Holloway and others, Nicholl & James's direct copper process, the great improvements in the production of electrolytic copper, nickel, aluminum, etc., the extended use of various forms of the electric furnace, all these have tended to revolutionize pyro-metallurgy by cheapening methods and extending the scale of working so that we now understand by a large smelting plant one like that at Washoe, which can deal effectively with 10,000 tons of ore per day; and in all this the alumni of the Royal School of Mines have borne a creditable part. There have, too, been many improvements effected in ventilation, sanitation, and safer working, partly brought about by the extension of Government inspection (and here too the Royal School of Mines has supplied some of the best inspectors), and partly resulting from the extension of technical education and the general march of knowledge, and all these have tended to the amelioration of the lot of the miner.

And now may I conclude this hasty survey of our field of work by offering you a few words of practical advice of an almost personal character. You who aspire to control men must be students of men, whether your subordinates, equals, or superiors. In particular you must know and appreciate good workmen when you meet them and must learn how to bring out the best even of the bad ones. Some workmen are jealous and will tell you nothing, or even tell you wrong; others will say what they think will please you for the moment, or what will give them the least trouble; others again, while quite willing to impart what they know, have no accurate command of language and you will have to carefully interpret their imperfectly expressed ideas for yourselves. In learning his work therefore, the aspirant must be modest—carefully avoid putting on airs—remembering that however much he knows, unless he knows what the workman knows of any particular operation and a little more, that workman will not recog-

nize any superiority in him. I would advise you, when you begin your post-graduate practieal work, to be neither too familiar nor too stand-offish with men who are acting under you, but who necessarily know more than you do of the immediate work. Again, if you should lower yourself by using the coarse language that is too eommon among workmen, they will not think better but worse of you for doing so. And there is no oeeasion for you to be forever taking pick, shovel, or wheelbarrow out of their hands, though it may be neeessary to do even this sometimes. But they will never think the worse of you if you are even more ready than they in an emergency to do any work that is dirty or disagreeable or dangerous. Then, as to your relations with those under whom you are placed. I need hardly say you should be always loyal and industrious; if your superior is of the right kind, be also zealous and stick to him till he earries you up with him. If, unfortunately, he is of the wrong sort, be loyal still, but get away from him to someone else as soon as you feel that there is no more to be learnt while under him.

You should be always trying to realize the differences in essential conditions. For instance, where ore is more plentiful than fuel or labor, you may waste ore to save fuel and labor, and the reverse. Again, except where time is of importanee, the steam-shovel is as much out of plaee in China or India, where men ean be got for 3d. per day, as the wheelbarrow in the United States where men get $4 per day. In foreign works, endeavor to utilize native labor as mueh as you can; it is always eheaper and generally less troublesome, but, of eourse, you must take the trouble to learn something of the native's language. When steam or machinery is employed, endeavor to keep it fully employed; where you have electricity at command generated by water-power, this, of course, is far less important.

Try to know some one branch of your profession as well as it ean be known; learn a little of everything else, so as to be in a position to appreciate the work of others and to know where to look for help in an emergeney. Be sociable and self respecting—not secretive or jealous, be a good comrade, take up a hobby by all means as a recreation outside your work, but avoid fads. Above all, don't expect others to fall in with them; and live 'the strenuous life.'

As to the spirit with which you should work, keep a due balanee between conservatism and radicalism. The man who never sees any line of improvement is of little value to an employer; on the other hand, he who is forever tinkering—'perfecting' as he ealls it—never arriving at a working conelusion, is even more unsatisfactory. And when you reach the position that gives you the power to 'scrap' maehinery or to introduce new proeesses and methods, be sure that the improvement aimed at is one that ean be fully realized, and that the scale of working is large enough to warrant the change before you enter on a revolution. Don't be too ready to despise old methods; they can very often be improved upon, but not until you have mastered their full meaning. "*Festina lente*" is a good motto, and if to industry and loyalty and perseverance you ean add a due sense of proportion, and that imagination which enables you to see things as they will be before they exist, your suceess is assured.

TREATMENT OF SULPHIDE ORES BY THE HUNTINGTON-HEBERLEIN PROCESS.

Contributed to the MINING AND SCIENTIFIC PRESS
By L. S AUSTIN.

In treating over 1000 tons of ore in a 50-ton plant by this process the loss in weight was 25%. There was a gain in gold of 7%, a loss of silver of 1.4%, lead of 8.5%, and of copper 1.4%. The ore, after roasting, contained 5.5% sulphur, and its analysis was much as follows: SiO_2 6, Fe 35, Cu 1, Zn 8.5, Pb 15%, and silver 21 oz. per ton.

The following figures for costs of roasting and pot-roasting may be given:

13 men @ $2.50 per day	$27.34
Foremen (part)	1.40
Fuel for roasting (slack coal) 6 tons @ $1.55	9.30
Power (estimated)	3.00
Lighting "	0.40
Repairs and supplies (estimated)	2.50
Treating 13 tons @ $1.02 per ton	$43.94

Comparing this result with that of the long-bedded hand-rabbled reverberatory roaster we have $2 for roasting and 60c. for briquetting, making a total of $2.60 per ton. Moreover, the H. & H. process costs $1.02, and gives a better product for smelting. In addition we may say that the losses in lead in reverberatory-furnace roasting will reach from 11 to 17 per cent.

Vanadium is obtained from lead vanadate ore with about 14% vanadic oxide and 50% lead by the Herrenschmidt method. The ore is smelted in a reverberatory furnaee with carbonate of sodium and coal. Metallic lead carrying all the silver is formed, together with a slag containing vanadates, aluminates, silieate of sodium, and oxide of iron. To render this slag soluble in water, it is melted in a reverberatory furnaee and, after melting, is blown with air until the vanadium is completely oxidized. The mass is then poured into boiling water to granulate it. After three leachings, the residues consist chiefly of alumina, silica, and oxide of iron containing not more than 2% of vanadic acid, that is 95% of the VO_3 in the ore is in solution. The vanadate solution is then evaporated to a syrupy consistence, and some sulphuric acid is added. About 90% of the vanadium is precipitated, and then the liquor is rendered alkaline and purified by filter-pressing, and the remainder extracted. In this way vanadic oxide containing 92 to 95% VO_3 is obtained.

The exports of fuel from the United Kingdom during the first quarter of 1908 totalled 5,059,222 tons of coal, coke, and patent fuel. This was an inerease over the shipments for a corresponding period last year, and the average price per ton is now 13s. 1d., showing a material advance over 12s. 2d., the average for last year. While the rate of increase in the exports is not fully maintained, the shipments of coal and coke continue to improve, and this branch of the mining industry is quite satisfactory.

MINE REPORTS.

BROKEN HILL SOUTH SILVER MINING CO., NEW SOUTH WALES.

The last report, issued in February, dealing with the half-year ending Dec. 31, 1907, gives gross results, and details of production, but is lacking in analysis of costs. The financial condition of the company is briefly stated by the directors as follows: "During the period under review £70,000 has been distributed among shareholders in dividends, £64,000 has been expended in plant and machinery, £10,000 has been written off plant accounts, additional expenditure on the new shaft amounting to £3374 has also been written off, and £2000 has been set aside for income tax. The net liquid assets amount to £46,132."

The total production of the mine for the six months was 111,009 tons, yielding an average of 15% lead, 12.3% zinc, and 5.04 oz. silver per ton. The bulk of this tonnage has come from the 725 and 825-ft. levels. The deepest level, at 970 ft., yielded over 2000 tons of ore, having a grade slightly higher than the general average of the mine. Development has been active throughout the property, reaching the respectable total of 7704 ft., of which one-half was on the bottom level. The report distinguishes between the full number of employees enrolled and the average daily attendance, the respective figures for surface and underground being 617 and 742 enrolled, and 503 and 653 checked off, making a total daily attendance of 1156. Taking the total laborers employed underground, it appears that the average output per man for the six months was only 0.94 ton per day. The costs per ton of crude ore were:

Mining	13s.	4.7d.	= $3.21
Development	3	0.4	= 0.73
Concentration	4	11.7	= 1.19
	£1 1s.	4.8d.	= $5.13

COBALT DISTRICT FOR 1907.

A summary of the operations in the Cobalt district has been prepared by Arthur A. Cole, mining engineer to the Temiskaming & Northern Ontario Railway Commission, and issued by the Commission. It shows a grand total output of silver for the year 1907 of approximately nine million ounces, estimated to have a value of $5,900,000. This was derived from 14,851 tons of ore, making $397 per ton. The tonnage increased from 5836 in 1906, with a value of $3,573,908, which indicates, according to a statement of the Ontario Bureau of Mines, not that the richness of the ore is decreasing, but that a larger proportion of low-grade ore is being shipped. Of the ores shipped 17.4% was treated in Canada and 81.47% in the United States, the remainder being taken in England. The Orford Copper Co. took practically all of that staying in Canada, effecting settlement on the basis of 94 to 80% of the silver, graduated in accordance with the silver content from ores carrying 4000 oz. or more down to 150 oz. or less per ton; purchaser to pay $30 to $10 per ton between the limits of 12 to 6% cobalt, no payment being made for cobalt when present in less amount than 6%, nor when the nickle content exceeded the cobalt; all ores to be shipped f.o.b. cars at Copper Cliff, Ontario. The schedule of the American Smelting & Refining Co. applied to ores from Cobalt, was as follows; for ores assaying under 1500 oz. per ton, 93% of the silver content at New York quotations as given by Handy & Harman to the Western Union Telegraph Co., 30 days after agreement on assays; $9 working charge per ton of 2000 lb. dry weight, plus ½c. per ton on each ounce of silver contained; arsenic above 5% penalized at the rate of 25c. per ton for each per cent; and an additional charge is made for each per cent of insoluble matter present above an amount equal to the percentage of iron present. The freight on ore from Cobalt to Perth Amboy, N. J., is $10.20 per ton. The mines of the district have now 74 steam plants, 2 gas-producer plants, and 51 compressor plants. There are four mills in operation and two custom mills nearing completion.

Decisions Relating to Mining.

Specially reported for the MINING AND SCIENTIFIC PRESS.

MINING CLAIM, INVALID JUDICIAL SALE.

Mere acquiescence by the debtor in an invalid judicial sale of his interest in a mining claim was held not to amount to an abandonment of the claim.

Crary *v.* Dye, 28 Sup. Co. Rep. 360, Feb., '08.

A senior locator may lose his right by failing to adverse.

Nash *v.* McNamara, (Nev.) 93 Pac. 405, Jan., '08.

MINING CLAIM—POSSESSION WITHOUT PATENT.

The right to a patent for a mining claim depends upon making the proper location, or upon having held possession during the period of the statute of limitation. So long as the statutory amount is expended each year upon the claim, the owner's right to exclusive possession and to extract and exhaust the ore is as complete as if he held a patent. The making of the location and the time for making it have no reference to the statute regulating the proceedings upon application for a patent.

Nash *v.* McNamara, (Nev.) 93 Pac. 405, Jan., '08.

MINING—EMINENT DOMAIN.

The exercise of the power of eminent domain cannot be invoked in aid of the business of mining for the benefit of the owner, for this is a purely private enterprise.

Sutter County *v.* Nicols, (Cal.) 93 Pac. 872, Jan. '08.

LOCATION OF CLAIM—DESCRIPTION, ETC.

The discoverer of a veln or lode may locate a claim by defining the boundaries thereof in the statutory manner, and by posting at the point of discovery a notice containing the name of the lode or claim, the name of the locator, the date of the location, the number of linear feet claimed in length along the course of the vein, with the width on each side of the center, and the general course of the vein or lode. Before the expiration of 90 days from the posting of notice of location, the locator shall sink a discovery shaft upon the claim of the depth of at least ten feet or its equivalent.

Nash *v.* McNamara, (Nev.) 93 Pac. 405, Jan., '08.

MINING CLAIM—POSSESSION THROUGH TAX-DEED.

A statute provided that mining claims, whether patented or entered for patent or not, should be assessable and taxable on account of producing gross proceeds, then and in that case the possession should be the subject of assessment, and in case such mining property should be sold for taxes levied, such sale should pass the title and right of possession to the purchaser. Under this statute a valid subsisting mining location was property distinct from the land itself and taxable; the right of possession of the land for mining purposes, and not the land itself, was the subject of taxation; that a tax deed under a sale conveyed the right of possession, but affected no interest of the United States; the tax deed upon its face was a valid instrument, and after the statutory period of limitation constituted a superior title to the claim of grantee from the person originally in possession.

Elder *v.* Wood, 28 Sup. Ct. Rep. 263, Jan., '08.

OIL LEASE—IMPLIED DUTY OF LESSEE.

Where an oil lease failed to specify the number of wells that should be sunk by the lessee, and did not require the sinking of offset wells to protect the land from drainage, yet it was held that from the nature of the contract an implied obligation rested upon the lessee to use reasonable diligence and care to develop and protect the property; and that he was bound to sink as many wells as the exercise of due diligence and care would suggest to an ordinarily prudent person engaged in the same undertaking under the same circumstances.

Guffey Petroleum Co. *v.* Jeff Chaison Townsite Co., (Tex. Civ. App.) 107 Southwest. 609, Jan., '08.

A NEW CHROME-STEEL CONE-HEAD.

The accompanying illustration shows a new method of making cone-heads for gyratory crushers, which is claimed by the manufacturers, the Chrome Steel Works, of Brooklyn, N. Y., to offer all the advantages familiar to users of chrome steel, together with greater strength and freedom from danger of breaking. The tapered ribs or corrugations are made from forged and rolled chrome steel, cut to required lengths, placed in a mold, and a soft steel backing then cast around rear projections from the ribs, interlocking and cast-welding the entire cone-head into one solid piece. The ribs are heated to a temperature just below

cherry red, before the molten steel is cast, and a perfect union with the ribs is effected. The casting is re-heated after removal from the mold, and then submerged in a special bath. This process hardens the chrome steel ribs, but does not affect the very mild crucible-steel backing, the latter carrying less than 0.25% carbon. The ribs, however, become so hard as to resist the action of a file. The Chrome Steel Works make these cone-heads to fit either the No. 6 Gates or the No. 5 McCully gyratory crushers. The new type of cone-head described is on the same principle as the chrome steel jaw plates with soft-steel backing, which have demonstrated their efficiency in practice. George W. Myers, 724 Kohl Bdg., San Francisco, is the Pacific Coast representative of the Chrome Steel Works.

PUBLICATIONS RECEIVED.

The Geological Survey has published the following bulletins: 'No. 327, Matanuska and Talkeetna Basins, Alaska,' by S. Paige and A. Knopf; 'No. 319, Controlling Factors of Artesian Flows,' by Myron L. Fuller; 'No. 336, Washing and Coking Tests of Coal, and Cupola Tests of Coke.'

CATALOGUES RECEIVED.

THE DENVER ENGINEERING WORKS CO. have issued Bulletin No. 1029, describing mine timber framing machines.

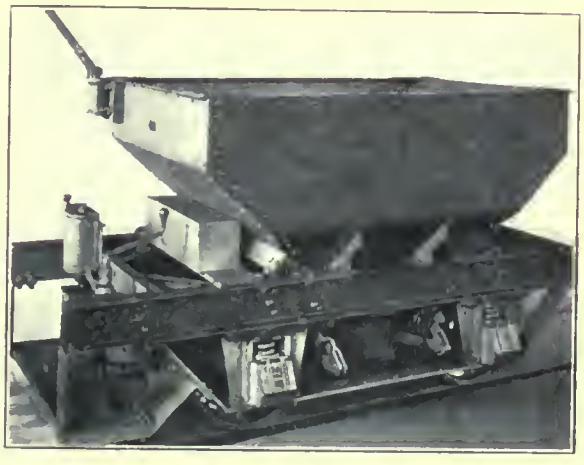
THE TRIPLEX ROLL CO., of Denver, Colorado, has issued Catalogue No. 2, describing a grinding machine, presenting several new features. The old system of rolls is modified by the insertion of a third and larger roll between the faces and at right angles to the rolls as ordinarily used. This feature of construction gives two grinding faces, and the faces are thus automatically kept true.

BOTTOM-DELIVERY ELECTRIC CHARGING CAR.

In the equipment of smelters and concentrators, which are today handling at good profits the low-grade material which ten years ago was looked upon as worthless, electricity is a most important element, and the electric charging car, which is used to convey the material to the furnaces, plays an important part in the work. After the ore has been received from the mines in railroad cars, crushed to the proper size and deposited in storage bins, the electric charging cars come into play. These are used to convey fuel, ore, and, in fact, all the raw material used and consumed around a smelting plant.

When a furnace is in blast it is kept so for an indefinite period. This requires cars and equipment made of the best material and workmanship possible to obtain in order to stand the rough usage. Also the car must be loaded and carried to its point of distribution rapidly, having ample power at all times for uninterrupted operation.

The accompanying illustration shows a type of car in use in a number of the largest smelters and concentrators,



known as the Atlas centre dump, swinging door design. The door swings outward, with the lever adjacent to the operator on the platform. The sides and ends of the car are of the steep-angle design, so that the material will not adhere, giving a clean delivery at all times. The framework and body are especially strong and well braced. The wheels are made of material to stand the hardest work, and are ground to insure maximum adhesion. The bearings are dust-proof, and waste-packed to insure protection and easy running. The brakes are of the standard street-car enclosed ratchet-handle type.

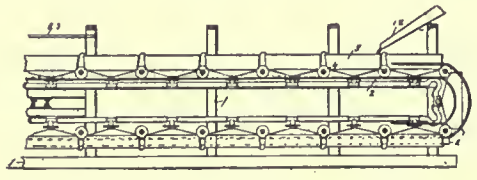
The electrical apparatus consists of a Westinghouse No. 64 motor, with type 'R' controller, enclosed resistance, circuit-breaker and cut-out switch, reversible spring-type trolley, having standard trolley wheel. The cut-out switch is operated from the platform, and when the operator leaves the platform the current is cut off. This is for safety and avoids accidents, particularly as these cars are operated under very close clearance conditions. The wiring is specially incased in water-tight conduits to protect it against gritty material, which might wear the insulation.

These cars are manufactured by the Atlas Car & Mfg. Co., Cleveland, Ohio; the electrical equipment by the Westinghouse Electric & Mfg. Co., Pittsburg, Pa. They are now in use at such well-known plants as the Garfield Smelting Co., Garfield, Utah; Utah Copper Co., Murray, Utah; Ohio Copper Co., Salt Lake City; Michigan Smelting Co., Houghton, Mich.; and the Anaconda Copper Co., Anaconda, Mont. The specifications of the car are: capacity, 5 tons; gauge, 36 in.; wheels, 21 in. diam.; length over all, 11 ft.; width, 5 ft.; height, from top of rail to top of car, 5 feet 6 inches.

MINING AND METALLURGICAL PATENTS.

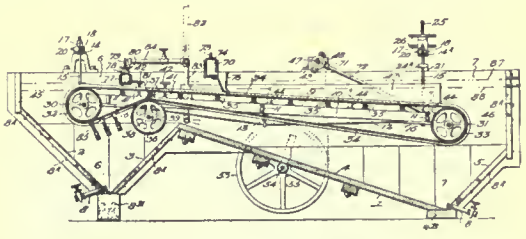
Specially Reported for the MINING AND SCIENTIFIC PRESS.

PROCESS FOR SEPARATING THE LIQUID FROM THE SOLID PORTIONS OF TREATED ORES.—No. 885,004. Edward P. Lynch, Mill Valley, California.



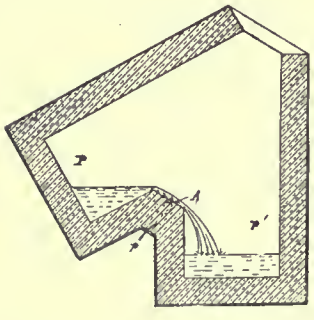
The herein described process of separating the liquid from the solid portions of treated ores and other substances, which consists in simultaneously subjecting a substantially thin body of the same, while in an extended form, to the action of suction from the bottom and decantation from the top.

SUBMERGED ORE-CONCENTRATOR.—No. 884,636. Charles L. Buckingham, Denver, Colo., assignor of one-half to Robert B. McCouney, Denver, Colorado.



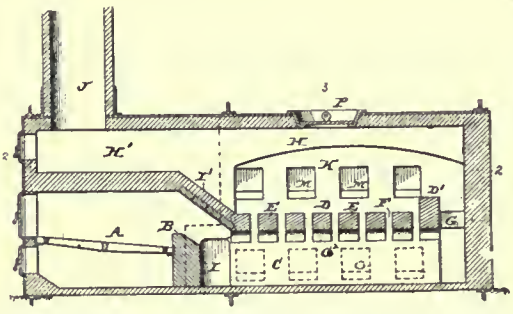
A submerged concentrator, comprising a tank adapted to contain a body of water, an inclined endless traveling belt concentrator suspended in said tank, means for adjustably raising and lowering said belt, an adjustable speed driving mechanism operatively connected to said endless belt concentrator and arranged to feed it continuously toward its highest or head end in said tank, a reciprocating movement mechanism connected to said concentrator and arranged to impart a rapid reciprocative vibratory movement to said concentrator, means for feeding ore pulp to said concentrator, splash boards on opposite sides of said belt adapted to confine the feeding ore to said belt, means for feeding clean water to said concentrator, and means for regulating the height of said body of water, to wholly or partially cover said concentrator.

PROCESS OF UTILIZING THE METALLOIDS IN CRUDE IRON FOR REDUCING METALLIC IRON.—No. 885,248. Henry D. Hibbard, Plainfield, New Jersey.



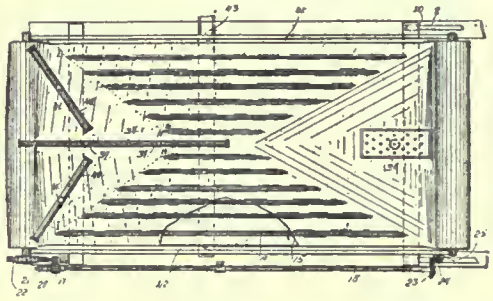
The mode herein described of utilizing the calorific power of the metalloids in crude iron in its reduction of iron from the oxid to the metallic state, said mode consisting in charging a vessel with a quantity of molten crude iron and adding thereto a quantity of oxid of iron, and mechanically agitating the mixture, the quantity of oxid of iron being so proportioned to the quantity of crude iron that the charge is maintained in molten condition by the oxidation of the metalloids in the crude iron without substantially affecting the carbon.

INCINERATING-FURNACE.—No. 885,380. John Ross, Philadelphia, Pennsylvania.



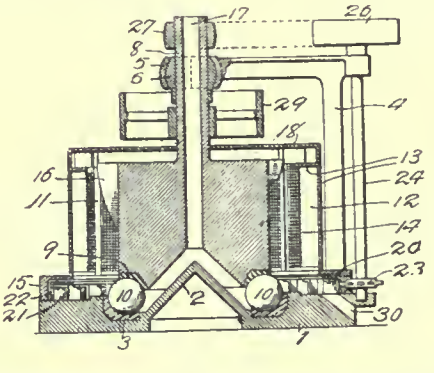
In an incinerating furnace, the combination of a grate, a lower flue leading therefrom through which the flame passes, an incinerating arch having openings through it arranged above the lower flue, an incinerating chamber immediately above the incinerating arch and connected with the lower flue at its end most distant from the grate, a chimney flue leading from the incinerating chamber to the chimney, a lateral incinerating chamber opening laterally from the incinerating chamber above the incinerating arch and provided with an incinerating arched floor having openings through it, flues for causing hot gases to pass under and then over the arched floor of the lateral chamber, and means for charging the furnace with garbage.

CONCENTRATING APPARATUS.—No. 885,692. James P. Evans and Randall P. Akins, Denver, Colorado.



A concentrator comprising a table or concentrating surface having a forwardly and centrally located depressed feed space, a centrally located longitudinally disposed apex extending rearwardly from the feed space, the top of the table being transversely inclined on opposite sides of the apex, said sides being provided with longitudinally disposed riffles arranged parallel to the apex, suitable means for feeding the material to be treated, to the forward portion thereof, and suitable means for supplying the table with wash water, substantially as described.

PULVERIZING-MILL.—No. 885,211. Levi D. York, Portsmouth, Ohio.



In a pulverizing mill, the combination of a driver, a shaft therefor, an annular chamber into which pulverized material falls, an annular conveyor in the chamber, a pinion engaging the conveyor, a pinion shaft, pulleys on the driver and pinion shafts, and a belt connecting the pulleys.

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Editorial.

THE DECLINE in the price of silver is due to the diminished demand from India and the lessened consumption of metal in the arts. Since the beginning of the year London has shipped to India only half the amount that went out in the corresponding period of last year. China has been selling freely.

"IT'S WRONG, but it's business," was the excuse of a New York stock-broker named McIntyre, when called upon to explain his action in hypothecating securities deposited by customers in trust with his firm, which recently failed. The secretary of the Stock Exchange promptly issued a denial of any such custom, and stated that every member knew that such a practice was reprehensible. Meanwhile McIntyre had confessed that a large amount of securities deposited with his firm for transfer, or other purposes than as security for marginal transactions, had been used by the firm as collateral for loans. "It's wrong, but it's business," said he. And that is the motto of graft all over the country, from New York traction steals to San Francisco trolley briberies. It is wrong and it is theft.

THE ROBINSON mine, according to the annual report just issued, made an operating profit of £904,270, or $4,385,710, in 1907. The dividends amounted to £660,000, or $3,201,000, on a capital of £2,750,000. The gold produced was worth £1,277,198, or $6,194,410, so that the profit was 70 per cent. Thus the leading mine of the Transvaal remains the greatest gold mine in the world, greatness in a mine being measured by the profit yielded. This profit has been increased lately by the fact that the mine is now fully developed to its boundaries; the usual cost of development has been 75 cents. The Robinson is now undergoing exhaustion, without compensatory development. The Homestake crushed more ore and the Goldfield Consolidated produced more gold, but neither of them approached the Robinson in the dividends distributed to shareholders, and that is the primary purpose of digging a hole in the ground.

FUTURE PROSPECTS of profitable mining in India centre around the Mysore mine, which has found good ore after passing through a poor zone. This mine has enough ore to maintain the present rate of production for nearly five years and the profit assured represents 66 per cent of the market valuation. The deepest workings are now 3600 feet on the vein. The Champion Reef also is doing well, while the Nundydroog and Ooregum almost hold their own as regards dividends, despite a diminution of output. On the whole the history of the Kolar goldfield has been unexpectedly satisfactory,

the lodes have proved far more persistent than anticipated in the early stages of development, and the profits have been maintained much longer than financial critics expected. To John Taylor & Sons, as managers, the results are largely due, even though "a good bal makes a good cap'n"; it is delightful to credit so striking a success to so old a firm of engineers.

WE HAVE RECEIVED several enquiries regarding the Mining Exposition to be held in Madison Square Garden from May 25 to June 20. Mr. W. M. Porter is the originator of the enterprise and we are assured that it is not a scheme for selling mining stock but a legitimate and praiseworthy effort to educate the public in mining methods. There will be a fine display of minerals and machinery, besides a drilling contest.

Reports and Prospectuses.

OUR esteemed contemporary, *The Canadian Mining Journal*, asks whether it is right for a mining engineer to report upon a mine in which he is financially interested. The question is prompted by the fact that Mr. J. Parke Channing, vice-president of the Miami Copper Company and consulting engineer to the underwriting syndicate, made the report appearing in the prospectus recently issued. In several respects this was a model prospectus, but was it proper for the participating engineer to prepare the prospectus report? The same criticism holds true of the reports by Messrs. A. C. Beatty and O. B. Perry appearing in the Yukon Gold prospectus. Both these gentlemen are directors of the company and directly concerned in the outcome of the enterprise, even if they shared no responsibility in Mr. Lawson's attempt to extract money from simple people. Here we have a question worthy the consideration of professional men.

In the first place, none of the gentlemen mentioned can be charged with sailing under false colors, for in both prospectuses it is stated frankly enough what professional relation they bear to the companies whose properties they appraise in their reports. Obviously there is no desire to hide the fact either that Mr. Channing is under retainer to the Lewisohns or that Messrs. Beatty and Perry are in the employ of the Guggenheims. No one is told even inferentially that the opinions are those of unbiased experts. And yet the majority of those who subscribed for stock will have overlooked the relation between the engineer and the promoters, they will have bought shares on the supposition that the reports expressed the authoritative conclusions of men well fitted to give advice to the public. As a matter of fact, scarcely one of the intending speculators will have stopped to analyze the position. They will have been influenced as much by the reputation of the promoters as by that of the engineers; arguing that neither the Lewisohns nor Mr. Channing, neither the Guggenheims nor Messrs. Beatty and Perry, could afford to make themselves responsible for bad business. Moreover, even if an engineer be either financially or professionally associated with a promoter, does it necessarily follow that he cannot observe accurately, state facts truthfully, and arrive at a conclusion logically? Is not the first-rate engineer employed by Lewisohn or Guggenheim a better judge of mines than the average run of other men and is he not as likely to furnish a reliable estimate as any other fellow chosen by a putative purchaser of stock? Therefore, is it not rather finical to object to the use in a prospectus of a report made for the underwriting syndicate or the vendor company? Does the English company law prevent any complication of a similar kind? Is it not a fact that the reports printed in a London prospectus are the work of engineers paid by those interested in the disposal of stock and if the difference be that the engineers do not become directors until after allotment, does it make much difference as regards protection to the public or safeguarding of professional ethics?

To all of this we can reply simply and directly. Gratuitous advice is usually worth what it costs. A man who acts on the advice for which another is paid is apt to find himself playing the other fellow's game. The public loses in mining by speculating on the strength of data furnished by those whom it does not pay and who are in the pay of the promoter, whose business it is to sell something for more than it is worth. It is no aspersion on the honorable character of an engineer to say that we would rather take his advice when he is retained by us than when he is engaged by the man who is selling the mine to us; we would rather buy Miami on the report of Beatty, and we would consider it better business to purchase Yukon Gold on the report of Channing, simply because we might then get an opinion that was not crossed by conflicting interest. Of course, the ideal professional man would make the same report for the vendor as for the vendee; he would come to an identical conclusion as regards the worth of a mine whether he owned half of it himself or if it were owned by his worst enemy; he would not swerve in his appraisal whether he were paid his fee beforehand or the fee were contingent upon the sale of the mine after his report. But we do not live in an ideal world; engineers are human, promoters are predatory, the public is foolish. We live not in a dream-world but amid brutal realities, and the only means of escape from complications is by looking the facts fairly in the face. An engineer engaged by the owner of a mine is likely to emphasize the good points of it; an expert in the pay of a promoter is apt to state the favorable features of the new enterprise underwritten by his client. The average run of speculators (they love to think themselves investors) are usually losers in mines because they have no advice independent of those from whom they buy. Only too often they blame the engineer on whose report they bought, not realizing that such a report is the most favorable statement within the limits of truth and not a cold-blooded diagnosis disregarding the financial exigencies. The owner of a mine asks an engineer to examine it, the engineer gives a report based on the facts as he sees them, and he makes his report as favorable as circumstances permit, for is he not in the employ of his client? If the engineer

be engaged to examine the mine for a possible purchaser, he will look out for the weak features of the mine, will be alert to discover the reasons prompting the selling of it, being anxious to safeguard his client, and he will place his fingers on any factor likely to lessen the value of the property. It may be claimed that an upright man would make exactly the same report whether engaged by one side or the other; he might if appointed by a court of appraisal, but he is not so appointed; he is engaged to advise a man whose interest lies one way or the other in a business transaction. We grant that an engineer of absolute independence might assume the exactly impartial attitude of an official appraiser and he might refuse to deliver a report save on the understanding that it be accepted just as he choose to phrase it, and although paid by Guggenheim or Lewisohn he might write a report in which the weak points of a mine were as fully discussed as the stronger features—the uncertain price of copper emphasized, the difficulty of working frozen ground frankly stated! We do not say that such reports are never made. Occasionally the unfavorable features of an enterprise are brought down to the vanishing point and the engineer sees plain sailing ahead. This may have happened in the case of Miami or Yukon Gold. After all, the engineer who reports on a mine for a promoter is an advocate, truthful and honorable by every token, but engaged nevertheless to present the case in as favorable a light as he can in the interest of his client. He has not yet become quite as much an absurdity as the expert witness in mining litigation who under guise of giving technical testimony is really a scientific special pleader, committed to one side and expected to help that side to the utmost of his ability. On the whole, we believe that the recognition of the real position is best for the development of professional ethics and that make-believe is the worst enemy of progress in human affairs. And to make the situation plain, we say that it is well for the public to understand that when a report appears in a prospectus it represents a favorable opinion prepared by one who is in the employ of the company or syndicate that is offering stock for sale; the opinion is not necessarily unreliable nor untruthful, but the point is that it represents the most favorable conclusion possible with regard to the facts as stated in the interest of a seller.

It is not likely that the present practice in these matters will be changed suddenly, for who is to demand it? The buyers of shares are rarely able to unite in sending an engineer to examine a mine at the time of flotation, and promoters are hardly likely to give notice to whom it may concern that they have a deal in hand for organizing a company to work this or that mine, so that those likely to be interested may be ready to send a representative to examine the said mine. On the contrary, the position of the promoter is that of a man who has spent his time and money in ferreting out a good mine, and having found a prize he is willing to take part of his reward in cash from those who want to buy into it at an enhanced price, retaining the remainder for himself. As evidence of the character of the mine he furnishes a report prepared by an engineer in his employ, and if that engineer be a man of good reputation the report is likely to be substantially correct. If you think it is not, leave the stock alone; you are under no compulsion to buy. If you think well of it, join with some others in arranging for an independent examination. Honorable promoters will welcome such an investigation and it is cheaper than going ahead blindfold.

The engineer cannot keep himself wholly disentangled from the wiles of promotion, he cannot stand entirely aloof from the business world in which he moves, so it only remains for him to safeguard professional integrity by the utmost frankness in all his dealings. To that end, he should avoid taking a financial interest, share, or participation in the future profits of an enterprise to which he stands in an advisory capacity. If he does acquire, by purchase or bonus, such an interest, he must recognize the danger of self-deception and he must face the fact that men of sane judgment will doubt the trustworthiness of his opinion.

Conservative Finance.

OUR London correspondent makes complimentary reference to the conservative financial methods of the Mountain Copper Company, but we are able to correct an erroneous impression which he shared in common with many as to the motives leading to the reorganization in 1902. That was not done because of any embarrassment, immediate or prospective, resulting from the ascertained limitations of the size of the available orebodies, but as a convenient means of economically distributing accumulated funds in the way of a reduction of capital account. This was effected by organizing a new corporation, which became the assign of the old company, exchanging the original £5 shares for redeemable debentures of the new company having a face value of £4 each, in addition to a cash distribution of £1 per share. Since then, in 1905, a further distribution was made by the cash payment of £1 on each debenture, reducing the face value of each to £3. That makes a cash return to the shareholders of £500,000 in reimbursement on an original of £1,250,000, thus reducing capital account to £750,000. If a further £2 per debenture be paid, as likely will be done, the remaining £1 due per face value of debenture will, by the terms of incorporation, automatically become a share of the value of £1 in the new company. This new company issued nominal stock of £20 only, being barely sufficient to legally admit of incorporating a holding company with its board of directors. The debentures are secured by a trust, and the original shareholders are in the position of being debenture holders until such time as the original capital shall be written off to the level of £1, when the trust will be dissolved. All this was done merely as a means of avoiding the difficulty and expense attendant upon going into court each time that it should become desirable to reduce share capital by the distribution of an accumulated surplus.

Personal.

H. R. WAGNER is at Denver.

BEN. S. REVETT is at Seattle.

H. H. KNOX has gone to Siberia.

GILMOUR E. BROWN is in Bolivia.

H. F. LEFEVRE is at Reno, Nevada.

CHARLES M. MCNEILL is in New York.

F. T. BYRDE has returned to London from Egypt.

GEORGE A. SCHROTER is here, on his way from Mexico.

ARTHUR W JENKS was in San Francisco last Saturday.

J. H. ALLEN has returned to New York from the Caucasus.

ZERINA LANE has left San Francisco on his return to Australia.

C. H. MERRIAM, of Spokane, has been examining mines near Needles.

DAN F. O'BRIEN has left Manhattan and is now at Skookum, Nevada.

FRANK OLIVER is enjoying a short holiday at Santa Monica, California.

W. H. STAVER has returned from Ecuador and is now at Freeport, Illinois.

PERCY G. HOLMS has been appointed British consul at Guanajuato, Mexico.

EUGENE COSTE, of Toronto, has been examining the oil-fields of Chihuahua.

C. W. GILMAN is manager for the Nevada-California Co. at Lovelock, Nevada.

JOHN A. REID is returning from Triunfo by the *Curaçao*, arriving here next week.

GEORGE A. PACKARD has been to Round Mountain, Nevada, and is now at Los Angeles.

DAVID ATKINS, of DeGolia & Atkins, is examining mines in Sierra county, California.

GEORGE I. ADAMS has returned to Washington, after an absence of three years in Peru.

WILTON E. DARROW has returned to Sutter Creek after a short holiday in San Francisco.

FRANK W. OLDFIELD was here this week, on his way from British Columbia to Los Angeles.

F. L. PATTERSON is superintendent of the Esmeralda mine at San Felipe, in Oaxaca, Mexico.

O. A. KNOX succeeds A. E. HURLEY as manager for the Octave Mining Co., at Octave, Arizona.

WALTER G. PERKINS has returned to Ely, Nevada, from a visit to the Anaconda plant in Montana.

G. M. GOUYARD has been appointed consulting engineer to the Mexican Exploration & Mining Company.

ERNEST CRAIG, manager of the Last Chance mine, at Mogollon, New Mexico, will go to England this summer.

L. D. GODSHALL is managing director for the Arizona-Mexican Mining & Smelting Co., at Needles, California.

W. H. LINNEY, recently manager of the Nipissing mine, at Cobalt, has opened an office at 502 Hyde Block, Spokane.

J. BOWIE WILSON, formerly at Mt. Morgan, has opened an office as consulting engineer at Sydney, New South Wales.

F. N. FLYNN, manager of the La Rose and other mines at Cobalt, Ontario, has resigned and will return to Mt. Vernon, New York.

ROSS B. HOFFMANN and JOHN D. HOFFMANN announce their change of address to the First National Bank Bdg., at Oakland, California.

A. E. HURLEY, for eight years manager of the Octave mine and mill, near Congress Junction, Arizona, has resigned and has gone east for a vacation.

S. E. BRETHERTON, who has opened an office as consulting engineer at 532 Commercial St., San Francisco, retains his position as general manager for the Great Western Gold Co., in Shasta county, California.

Latest Market Reports.

LOCAL METAL PRICES—May 14.

Antimony	12@16c	Quicksilver (flask)	$45@45.50
Casting Copper	14¼@15¼c	Spelter	6½@ 7¼c
Pig Lead	4.60@ 5.55c	Tin	32½@34c

METAL PRICES.

By wire from New York.

Averagedaily prices in cents per pound.

Date	Electrolytic Copper	Lead	Spelter	Silver
May 8	12.50	4.21	4.64	52⅜
" 9	12.50	4.24	4.64	52¼
" 10	Sunday.	No market.		
" 11	12.50	4.25	4.64	52½
" 12	12.50	4.25	4.64	52¼
" 13	12.50	4.25	4.64	52⅜
" 14	12.50	4.25	4.64	52⅜

ANGLO-AMERICAN SHARES.

Cabled from London.

	May 7. £. s. d.	May 14. £. s. d.	
Camp Bird	0 14 0	0 12 9	ex div.
El Oro	1 3 9	1 3 9	
Esperanza	1 6 6	1 3 9	
Dolores	1 5 0	1 5 0	
Oroville Dredging	0 11 6	0 11 6	
Stratton's Independence	0 1 6	0 1 6	
Tomboy	1 11 3	1 10 6	

(By courtesy of W. P. Bonbright & Co., 24 Broad St., New York.)

MINING STOCK QUOTATIONS—NEW YORK.

	Closing prices. May 7.	May 14.
Bingham Central	½	½
Boston Copper	11⅞	12
Cumberland Ely	7⅞	8⅛
El Rayo	1¾	1⅜
Giroux Con.	3¼	3⅜
Guanajuato Con		2¼
Nevada Con	11½	12¼
Nipissing	6⅞	.....
Tennessee Copper	37⅜	38
United Copper	6½	7½
Utah Copper	29¼	30¾

(By courtesy of Hayden, Stone & Co., 25 Broad St., New York.)

SOUTHERN NEVADA STOCKS.

San Francisco, May 14.

Atlanta	$ 22	Manhattan Con	11
Belmont	1.07½	Midway	44
Columbia Min	18	Mizpah Extension	10
Combination Fraction	53	Mohawk	12.00
Daisy	1.22½	Montana Tonopah	1.55
Fairview Eagle	35	Nevada Hills	2.15
Florence	3.72½	Rawhide Queen	1.75
Gold Bar (Bullfrog)	9	Red Top	.....
Goldfield Con	5.67½	Sandstorm	30
Gold Kewanas	35	Silver Pick	20
Great Bend	33	St. Ives	32
Jim Butler	28	Tonopah Extension	95
Jumbo	.....	Tonopah of Nevada	7.90
Jumbo Extension	33	Tramp Con	18
Laguna	1.10	West End	42

(By courtesy of W. C. Ralston, 353 Bush St.)

COPPER SHARES—BOSTON.

	Closing prices. May 14.		Closing prices. May 14.
Adventure	2	Michigan	10
Ahmeek	68	Mohawk	55½
Allouez	29½	Nevada Con	12
Amalgamated	67¼	North Butte	64¾
Arcadian	3⅞	Old Dominion	38⅛
Atlantic	14¼	Osceola	92
Bingham Con	.....	Parrot	22¼
Boston Con	12⅛	Phœnix	50
Butte Coalition	25	Quincy	85
Calumet & Arizona	110¼	Rhode Island	3¼
Calumet & Hecla	660	Santa Fe	2
Centennial	25½	Shannon	13⅞
Con. Mercur	40	Superior & Pittsburg	13⅛
Copper Range	74	Tamarack	60
Daly-West	8	Trinity	15
Franklin	7¾	United Copper com	7½
Granby	.....	Utah Copper	30½
Greene-Cananea, ctf	9¼	Victoria	3
Isle Royale	21¾	Winona	5¾
Mass	3	Wolverine	136

OBITUARY.

R. F. MOSER, chief mechanical engineer of the Boston Consolidated Mining Co., died at Salt Lake on the 5th inst., as the result of an operation for appendicitis. The deceased drew the plans for the Cactus mill of the Newhouse Mines & Smelters Corporation, in Beaver county, Utah, and later that of the Boston Con., at Garfield, Utah.

General Mining News.

ARIZONA.

COCHISE COUNTY.

The Virtue Co. has resumed operations on its property at Portal, employing four men in two shifts.——The Consolidated will sink a two-compartment shaft to the copper orebodies recently uncovered in the Emerald. They will utilize the first 100 ft. of the single-compartment shaft in the Silver Plume.——The shaft of the Warren Realty & Development Co., below the Warren townsite, has reached a depth of over 700 ft. Last month a bonus of $250 was distributed among the employees on account of the great progress made in sinking.

MARICOPA COUNTY.

The Baltimore group of mines, in the Hassayampa district, has been sold to Lester Jackson, who proposes to run an adit to strike the vein at a depth of 400 ft. There are already several hundred feet of underground workings on this property.

MOHAVE COUNTY.

The new hoist of the Nighthawk is in place and the property is being unwatered.——The Southwest Gold & Copper Co. has been organized to take over and work a group of claims in Lost Basin, 70 miles north of Kingman.——The Idaho-Columbus mill is running steadily on ore from the Vanderbilt mine.——Several carloads of lumber were received this week and are being hauled out to the Tom Reed mines.——Howard Wells has taken a contract to sink a 100-ft. shaft on one of the claims of the Expansion group.

SANTA CRUZ COUNTY.

The cross-cut which the Globe Con. Copper Co. is driving from the Gem shaft to the Future vein is now in 885 ft., 50 of which is in ore assaying 18% iron, 14% sulphur, and 2% sulphide of copper.——The Gringo mill, five miles from Patagonia, was started last week. At present only five stamps are dropping, but an additional five have been ordered and will be started as soon as they are in place.——Strange as it may seem, Mexican miners are still washing gold from the gravel in Old Patagonia canyon, 12 miles southeast of Patagonia. They use the primitive board rocker and it is claimed they earn from $25 to $40 per month.

YAVAPAI COUNTY.

The Alvarado mine, five miles east of Congress Junction, is being put in condition and new mining and milling equipment installed. From the old shaft, which is 1100 ft. deep, some important drifts have been driven, and good ore uncovered. At a higher point a new shaft is being sunk, the depth now attained being 500 ft. For this work a new hoist was installed. The original mill had 10 stamps, to which 30 more have been added. Tube-mills are also being installed for fine-grinding preparatory to cyaniding. The ore contains gold, largely in association with iron sulphide. Charles Lynch, formerly of Gold Road, is metallurgist in charge.

The A. S. & R. Co. smelter management at El Paso, Tex., has announced a cut of 40% in treatment charges for Arizona ores, through its agent at Prescott; and at the same time the transportation rate on ores shipped from western Arizona points has been reduced from $11.05 to $5.50.

YUMA COUNTY.

The Colonial Co. expects to begin the production of mercury at their property 12 miles north of Quartzsite, within two weeks. The ore is treated for gold and silver after the mercury is extracted. The new furnace has a capacity of 30 tons per day.——S. Markwell & Son have purchased a half interest in the Hottentot group of claims 15 miles east of Parker. It is said the consideration was $75,000, and the agreement to do an immense amount of developing soon. The ore is reported to run 35% copper and $10 to $40 in gold.

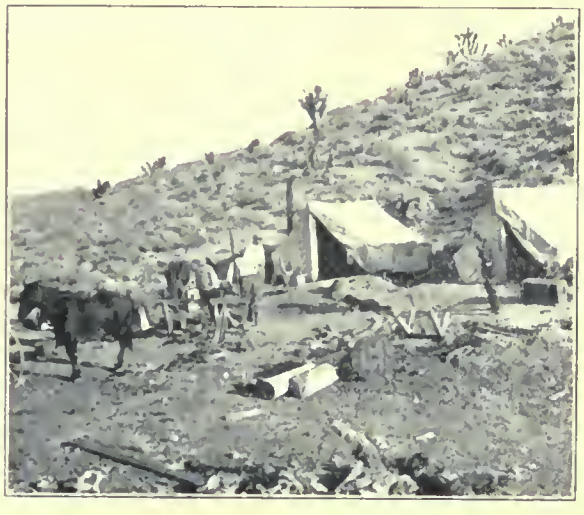
CALIFORNIA.

INYO COUNTY.

The Golden Gate has let a contract to George Stevens to drive their adit 400 ft. farther. The Golden Gate property is southwest of Buena Vista, and the railroad has established a flag station there, to be known as Russell.——The Stewart mill is treating a shipment of six tons of ore from the Brownie mine at Buena Vista.——Robinson & Wells report a rich strike on their property about four miles from Beveridge.

NEVADA COUNTY.

(Special Correspondence).—A rich vein of ore has been struck in the 600-ft. drift on the 500-ft. level in the Idaho-Maryland mine. Several pieces of ore assaying nearly $100,000 per ton have been taken out. The main vein has widened to 5 ft. The shaft will be cleared out and retimbered to the 1000-ft. level. Bray Wilkins is general manager.——Development work is progressing steadily at the Spring Hill.——Rich gravel continues to come from the Jenny Lind. Cross-cutting is under way to determine the width of the channel. The mill will be started soon.——



A New Camp.

The Cook vein has been cut by the south drift in the Gold Mound mine. The shaft will be sunk deeper and a drift driven to develop ore. Howard Dennis is superintendent.——It is reported that the South Idaho mine will resume operations within a few weeks.——A rich strike has been made in the lower level of the Siberia mine in the Cherokee district.——Preliminary work has commenced on the big drainage and development tunnel, known as the Twin City subway. It is expected to open up much virgin mineral territory.——The Marysville Tunnel & Gold Quartz Co. is developing a promising lode on their gravel property near Mooney Flat.——A drift is being driven to develop the Golden Crown group.——The Ethel mine will resume activities soon. A. Maltman is superintendent.——At the Golden Gate the working force has been increased and development work is under way. Good ore is coming from the lower levels. W. P. Martin is superintendent.——Work at the Bessie mine in Brown's valley is progressing steadily. Several men are employed.——The force at the Union Hill mine has been increased. It is understood that work will soon start at the Cold Springs and Buckeye groups.

Grass Valley, May 13.

PLUMAS COUNTY.

A new corporation, called the Indian Falls Co., has purchased the Shoo Fly property, near Quincy, and will develop the mine, lay out a townsite, and build a tourist hotel.——Gobert & Treleaven report a rich find on their Old Harry claim, about 12 miles from Quincy on Squirrel creek.

SHASTA COUNTY.

(Special Correspondence).—The dredge at Horse Town on Clear creek is being lengthened and changed from the

double-lift to the single-bucket type.——A suction dredge of the Dubois type is working in the Sacramento river at the mouth of Clear creek, and one of the same type on the river opposite Redding.——The Bully Hill is treating ores from the Winthrop, the Anchor, and the Bully Hill mines, and by mixing all three it is said the smelter is running in excess of its rated capacity.——The Winthrop has uncovered 16 ft. of good ore at the point where the new workings struck the old.

Redding, May 13.

(Special Correspondence).—Development work at the Gladstone mine near French Gulch has opened up a new ore-shoot. The mine is producing $20,000 per month, and the prospects of a steady output are excellent.——At the Midas mine at French Gulch 100 men are at work. The mill and cyanide plant are running steadily.——A new 60,000-volt power-line is being built by the Northern California Power Co. from the power-houses at the foot of the Sierra Nevada, with branches to the Mammoth Copper Co.'s smelter at Kennett, being the fourth line supplying this town, and to the Noble Electric Steel Co.'s plant at Heroult.——At the Yankee John mine near Centerville, a narrow vein has been found unexpectedly in sinking the main shaft, at 165 ft. The ore shows coarse gold. Sinking will be continued to the 200-ft. level before driving is begun.

Redding, May 13.

The Great Western Co. is receiving bids for the construction of a railroad from Bella Vista to its smelter at Ingot. The line, the location surveys for which are nearly completed, is standard gauge and 14 miles long. The Great Western is developing its property on the 600-ft. level.—— The Mammoth Copper Co. at Kennett has permanently closed down its saw-mill because lumber can be purchased cheaper than it can be manufactured.

TRINITY COUNTY.

The Fairview mill will be put in shape, and the management expects to have 10 stamps dropping by June 15. A tramway will be built from the lower workings of the mine to the mill.

TUOLUMNE COUNTY.

The new two-stamp mill at the old Knox & Boyle mine, near Steut, was burned last week. Besides the building in which the mill was, a concentrator and a slime plant were destroyed.——The plant of the Sierra Lime & Cement Co., at Sonora, was destroyed by fire last week, although the kilns and boiler are probably not ruined.——Another big pocket of gold has been uncovered in the O'Hara mine, north of Sonora. It is reported that this find is even bigger and better than the one reported several weeks ago.

COLORADO.

CLEAR CREEK COUNTY.

(Special Correspondence).—A bonanza strike has just been made on the Gambetta vein, intersected through the Joplin adit. In running the east drift, now in 200 ft., a streak of mineral 4 in. wide has been exposed that assays 100 oz. silver, 1 oz. gold, 60% lead, and 7% copper. For 150 ft. an 18-in. streak of 52-oz. silver and 60% lead ore has been followed. No effort is being made to break down the ore, as it has been decided to await the lifting of the bond before shipping. This is the first time in the history of mining on Republican Mtn. that gold in such liberal quantities has been found. The drift on the Gambetta vein is now directly under the old shaft workings, which were sunk to a depth of 70 ft. B. J. O'Connell serves as manager. ——During the month of April it is reported that 57 lb. of bullion was extracted from the amalgam plates at the Capital mill. The gold, which was sold at the U. S. mine at Denver, brought $16 per oz., making a total of $10,870. In addition to this, 40 tons of first-class concentrates was sold that netted $300 per ton, while the iron product, consisting of 160 tons, milled $27 per ton. The total production, not counting the smelting ore that was shipped, was $27,160. Another machine drill is to be brought into use in the breast of the Capital adit, now in 4800 ft. The next vein to be reached is known as the Sporting Times. W. M. Cooper is manager of the Capital M. & T. Co.——Shipments are being maintained from the Astor, where Butts & Co. is operating under lease on the 240-ft. level. Stoping is in progress on a 2-ft. streak of 350-oz. silver ore.——The Scepter adit is being advanced under contract, S. McKirahan having been the successful bidder. The bore is now in 2800 ft. and is to be driven 400 ft. farther, at which point a raise will be started to make connection with the Sunburst adit, after the completion of which all the ores mined on the west side of Democrat Mtn. will be brought out through the Scepter adit, the portal of which is on the Georgetown side. ——All the machinery for the Linn mill has now been installed, and the test run is scheduled for some time the coming week. The plant is modern in every respect and is equipped for straight concentration.——Work at the Hall adit has been resumed after 15 years of idleness. The old workings are being cleaned out and re-timbered. It will be necessary to equip the adit with new tracks, as a junk-dealer purchased rails, pipe, and compressor-plant a few months ago. B. J. O'Connell is manager of the new company.——The Socrates group of claims on Democrat Mtn. are undergoing development. The adit is now in 650 ft. and in the breast there is showing a 4-in. streak of silver-lead ore, which assays $65 per ton. The Tom Payne, which is a cross vein, will be reached within 20 ft. E. K. Cass is acting manager.——R. Fisher is driving the Hercules adit and is following a 10-in. vein of sulphide ore that carries silver as high as 300 oz. per ton. Occasional shipments are being made.——The Cully adit, on Saxon Mtn., is the scene of another important strike. In running the east drift on the Clyde vein an 18-in. streak of 175-oz. silver ore has been exposed. A heavy tonnage is being broken and shipments have been started. J. J. Cuily is manager.——The re-timbering of the Golden Glory adit is nearly completed. The company expects to install machine drills during the present month. According to surveys, the extension of the Bellevue-Hudson vein will be reached within 100 ft.——Heavy shipments are being maintained from the American Sisters mine on Columbian Mtn. Driving and stoping is under way on a streak of 400-oz. silver ore encountered on the 275-ft. level of the Headlight shaft workings. The 50-ton concentrating plant is running steadily, two grades of mineral being turned out. The first-class ore mills 300 oz. silver per ton and 25% lead, while the second-class is worth 97 oz. silver and 25% lead. Only the higher grade of ore is receiving treatment owing to low prices quoted on zinc. J. J. White is resident manager.——The Vesper group of claims, East Argentine, is undergoing development. The Bonham adit is being advanced to intersect the veins, and from surveys the Vesper lode should be reached within the next 25 ft. ——The North Star property is making an excellent showing, a streak of solid smelting ore having been uncovered that is from 3 to 4 in. wide. Tests upon the material show 19 oz. gold and 976 oz. silver per ton.——Shipments of smelting ore are now being made from the Wilcox adit workings. Lessees at work on the Commonwealth vein, 5600 ft. from daylight, are sending forth a heavy tonnage. Jameson & Sprousse are stoping on a body of mineral that is from 18 in. to 3 ft. wide, averaging $60 per ton in silver. Butler & Co., operating through the Tobin adit, are stoping on a 20-in. streak of $35 gold-silver-lead-copper ore.——The compressor plants at both the Wilcox and Tobin adits were started last week.——Shipments are being maintained from the Sporting Times mine, on Alpine and Griffith Mtn. The ore is a high grade and mills 1.54 oz. gold and 14 oz. silver per ton, with 62% lead. Stoping and driving is in progress, the orebody showing for over 50 feet.

Georgetown, May. 11.

GILPIN COUNTY.

The O. K. mine, on German Mtn., has been unwatered preparatory to sinking the shaft 100 ft. deeper. A winze is to be sunk from the sixth to the seventh level.——Jordan & McCallister are hoisting milling ore from their lease on the 200-ft. level of the Gold Collar mine.——Hawn & Emery, who are leasing in the San Juan mine through the La Crosse adit, in Nevada gulch, shipped a carload of smelting ore to the Argo plant last week.——Bennetts & Co. have taken a

lease on the Bull of the Woods mine, east of Galena, on Central City hill, and are putting the property in shape.——George Oldweiler & Co. are working the Justice mine, in lower Russell district, under a lease, and at present are doing some work in the 700-ft. level. The main shaft is down 800 ft., and the lessees expect to sink deeper.——Vosser & Co. have taken a lease on the Pewabic adit, in Russell district, and expect to do considerable development on the group.——Richards & Co., operating the War Dance property, in lower Russell district, have nearly completed the work of re-timbering the shaft to the 140-ft. level, and have their gasoline hoisting-plant in running shape.——Work will soon be started on the power-plant of the Seemann adit, on Fall river.——The mill at the Idaho Springs Reduction Works is being overhauled and will within 60 days be treating the ore from the Aduddell and the Half & Half properties.

SUMMIT COUNTY.

The Colorado-California Gold Mining Co. has been incorporated to resume operations on the Gold Dust claim.——Successful test runs have been made, both at the Wire Patch mill and the Colorado dredges.——The Blue Flag Mining Co., on Raven hill, treated during the month of March 600 tons of ore of an average value of $6, and shipped several thousand dollars' worth of bullion. A Tatman pulverizer is being added. The company's Laurium plant near Breckenridge is in constant operation and is turning out a high-grade concentrate. Another pulverizer is being added to this plant.——Thomas Gilroy, who has a lease on the Across the Ocean property on Breece hill, has started a new shaft 100 ft. west of the present shaft, and expects to tap the orebody which was struck in the old shaft.——Eight or ten men are employed on the Robert E. Lee property on Fryer hill, which is under lease to W. S. Jones and associates. The same men have also taken a lease on the Rupp Fraction, which adjoins the Lee, and are working both properties. Iron ore is being shipped from the Lee at the rate of about 30 tons per day, and considerable siliclous material is being taken from the Rupp.——Fred Cretney, who was leasing on the Forepaugh at the time the shaft-house was destroyed by fire last fall, has resumed operations on the property, and is now making regular shipments. Some repairs have been made on the surface plant, but the shaft-house has not been entirely re-built, as was at first proposed. The hoisting is being done through the Silver, which adjoins the Forepaugh. About 25 tons per day is being taken out and shipped to the Arkansas Valley smelter. The ore is principally silicious, but is said to contain from 40 to 50 oz. silver per ton.

TELLER COUNTY.

The mines in the Cripple Creek district during the month of April shipped a total of 1875 cars, with a total tonnage of 64,023 and a gross bullion value of $1,345,380. These shipments break all previous records so far as tonnage is concerned; however, the gross value is slightly less than that for March.——The fire which totally destroyed the shaft-house and machinery of the Lexington Gold Mining Co. on the west slope of Gold hill recently will not interfere with the plans of the company to a great extent. The head-frame, ore-house, and trestle were saved, and the present lessee, Iver Weston, will probably hoist his ore through the shaft of the E. Porter Gold King until an electric hoist can be installed.——The General Leasing Co., which has a lease on the Hardwood property of the United Gold Mines Co., has started operations. Modern machinery will be put in the 135-ft. shaft and cross-cutting started with the purpose of striking the famous Jerry Johnson vein.——The Anchoria-Leland Gold Mining Co. has started operations on the old ore-house dumps of the Anchoria Leland mine on the west slope of Gold hill. The dump, which is one of the best in the district, will be shipped with very little sorting, and good results are expected.——The Union Leasing Co. has resumed work on the Proper claim, which is on the northeast slope of Gold hill, near the C. O. D. and the El Paso Gold King.

IDAHO.

BOISE COUNTY.

A strike of free-gold quartz is reported on the property of F. H. Cooper, three miles north of Centerville.——The McKinley Mines Co. will start work on its adit within 30 days.——Work has been resumed at the adit of the Stockholders' Mining Co., southeast of Elkhorn.——An adit will be started to tap a vein on Chas. Clark's Elkmeat claim, west of Elkhorn.

IDAHO COUNTY.

J. O. Barbour, of Lewiston, has purchased the May Flower group on Deadwood Mtn., and has started an adit to cut the vein at the 150-ft. level.——Belor & Murphy have resumed development on their group of claims, near the South Fork mine.——The Good Enough mine, in the Marshall Lake district, has changed hands, the Irwin brothers, who have owned the property for several years, selling out to S. C. Edgar of St. Louis, Mo. A 10-stamp mill is to be installed this summer.——Elk Trail placer, at the mouth of Crooked river, will be started soon. Farr & Beekman, the owners, are installing a Ruble elevator.——The Gold Point, near Elk City, has started sinking the shaft to the 200-ft. level. A mill may be put in this year.

OWYHEE COUNTY.

A new transformer and motor were put in at the Potosi mine last week.——The crusher at the new Banner mill has been put in place. Everything will be ready for the mill to start as soon as the tramway is finished. A few more men have started work in the mine. All the work is being done in the No. 3 and 4 levels, and in the No. 1 level south of the raise.——The Atlanta mill, near Mountainhome, started crushing the ores from the Monarch mine last week. The mill has a capacity of 150 tons per day, and is equipped with both electric and water power.

SHOSHONE COUNTY.

(Special Correspondence).—The Last Chance mine at Wardner has resumed operations with between 200 and 250 men, and P. W. Peeples, superintendent, announces that 600 men will be employed at the mine and mill as soon as they can be assembled.——It is expected here that the Morning mine of the Federal Mining & Smelting Co. will be re-opened soon, but no definite statement can be obtained from the management. A few men are now employed there.——The Hecla mine at Burke has completed the installation of its new electric hoist, and this is now being tested, preparatory, it is said, to resumption of operations.——It is reported from the Champion mine that a new strike has been made there, equaling the recent strike of gray copper. This appears to be due to passing through a 'horse' which was 8 ft. in width. The new ore is said to be bornite and chalcopyrite of great richness.——Work will be resumed on the Idora, on Sunset Mtn., early in June, as the roads will then be passable. The property is developed by an adit in which galena of good quality has been found.——The Lucky Calumet mine will be operated with a full crew, beginning immediately, and work will be pushed. There has been a small crew at work for the greater part of the winter.——The Caledonia mine at Wardner has installed a new 5-hp. hoist, and this has been put in commission. Development work will be continued.

Wallace, May 11.

KANSAS.

CHEROKEE COUNTY.

(Special Correspondence).—The re-opening of the Bonanza tract and its development into active production has been one of the features of recent importance to the Galena camp. The land has been leased by a number of operators and a concerted effort made for unwatering the mines to a depth of 170 ft. The ground is mined from the surface to the 170-ft. level. The sub-lessees are working the shallow deposits while the half-dozen other companies are preparing to extensively develop the lower runs of ore. The Casco Mining Co. has been working for some time and has just completed the erection of a new concentrating plant.——On an adjoining lease of the same ground the Quincy

Mining Co. has taken a lease of six acres and has opened an 18-ft. face of high-grade zinc-blende at a depth of 44 ft. The second shaft is being sunk and driving has just been started. The excessive rainfall has retarded operations. ——Timothy & Co. have also taken a lease on the Bonanza ground and have the orebody well opened up for production. Better hoisting facilities have been installed and electrical power substituted for operating all the machinery.—— Harry C. Cooper and associates have just made a rich strike of zinc-blende in a shaft on this same ground. The ore cleaned upon hand-jigs is running 62% zinc.——An orebody of exceptional richness has been discovered between Fifth and Sixth streets, just behind the Century Hotel building. The deposit consists of galena in huge lumps and occurs at a depth of 120 ft. with a 7-ft. face. In opening up the drift the miners have been producing each shift 5000 lb. galena in pure chunks in addition to the milling ore. Beneath the run of galena a heavy deposit of zinc-blende was penetrated in the shaft.——At Cave Springs, northeast of Galena, the Herald Mining Co. has commenced milling the rich orebody recently opened. The ore occurs in a sticky chalky dolomite, being very hard to concentrate. The ore seems to break across both the blende and gangue rather than the gangue breaking free from the blende. This is the case even when the ore is crushed fine enough to pass a two-millimetre screen. The problem seems to be one of correct crushing, and other means than the ordinary Cornish rolls seems to be demanded. The ore mined runs as high as 25 to 30% zinc-blende and occurs in a sheet formation.——McCullagh & Murdock have undertaken the draining of the Hartley land, where over 30 shafts were productive in the early days. The land was mined to a depth of 110 ft. and some rich deposits worked, but were abandoned when the price of zinc ore dropped so low in the nineties. The land consists of 120 acres, which will be thrown open to lessees as soon as the draining of the tract has been effected.

Galena, May 11.

MISSOURI.

JASPER COUNTY.

(Special Correspondence).—The recent decision of the Federal Court at Laredo, Tex., that all zinc ores are to be admitted to the United States free of duty, has caused the mine operators of this district to realize the necessity of pushing the case to the U. S. Supreme Court for a final decision. The operators have already spent $10,000 in securing a decision from the New York Board of Appraisers favorable to the levying of a 20% ad valorem duty. This decision has been contested by the smelters and is pending in the courts. The last decision, by Judge Wallace Burns of the Federal District Court at Laredo, Tex., was the result of a case filed by Calvin G. Brewster, an American zinc mine operator in Mexico, to contest the decision of the Secretary of the Treasury. The decision makes it possible to import, duty free, not only blende, but the silicate and carbonate of zinc as well. Zinc ores having a lead content must pay a duty upon the lead content only. The smelter interests are using all the pressure they can, to get the Secretary of the Treasury to accept the decision of the District Court, but the mine operators of the Missouri-Kansas district and of Wisconsin are determined to carry the case to the Supreme Court. To that end the operators of the Missouri-Kansas district are forming an organization for the purpose of furnishing the necessary funds to continue the contest. The organization of the operators in this field has never been a success, but the present agitation has been along new lines. The raising of funds will be proportioned among the members according to the production, a pro ratum being assessed against the tonnage each week. According to this plan the fund available each week would range from $250 to $600—a sum amply sufficient to carry on the work outlined. Hitherto the funds have been provided from the contributions of individual operators.——The strike of the workmen at the Cherryvale smelters of the Edgar Zinc Co., which occurred last week, has been settled satisfactorily to the management and to the workmen, and according to the terms of the agreement the men returned to work this week. The Edgar Zinc Co. has five furnaces at this place and employs 350 men.—— The Bull Frog Mining Co., operating a 30-acre lease west of Joplin, at Smelter Hill, has enlarged the scope of its present workings by sinking a new shaft southwest of the mill. The new shaft is principally a lead producer, and has been connected with the concentrating plant by means of an inclined tramway. Southeast of the mill an especially heavy body of rich milling ore has been discovered and is now being opened by a drift driven from the old workings. The drilling has revealed enough reserve orebodies to run the present 300-ton mill for a number of years.——A new development of mining ground was made on the Lucky Jim Mining Co.'s land west of the city. The company has been developing a 12-acre lease by drilling and shaft-sinking. Two shafts are now in the orebody and the driving has revealed a large body of high-grade milling ore, chiefly zinc-blende. The company is erecting a 350-ton plant, which will be completed within a fortnight. The plant is modern in both building and equipment. This will make the third large producer in that immediate vicinity within the past nine months.——Still farther west, on the land of the Old Times Lead & Zinc Co., the Great Western Mining Co. has secured a new lease and is putting down a shaft to a sheet orebody at a depth of 200 ft. The company has sunk this shaft to 173 ft. already and will begin the sinking of a second shaft at once. In addition, a 350-ton concentrating plant will be erected during the opening of the drifts. This same company has purchased the mine and mill of the Old Times company at Central City and will re-open them as soon as the ground can be drained.——On an adjoining lease of the Black Cat land the Commonwealth Mining Co. has undertaken the development of two 10-acre tracts. One of these has been drilled and found to be underlaid with sheet-ore, and the sinking of shafts is now in progress. Upon the other the company is operating two steam-drills and will thoroughly drill the lease before sinking any shafts.——Another new plant is that of the Under Roof Mining Co., in course of erection on the land of the Granby Mining & Smelting Co. at Chitwood. The plant handles 200 tons in a 10-hour shift. The company is working two bodies of ore, one at 100 and another at 170 ft. The ore is zinc-blende in both levels. The company has just completed drilling the lease, and in three of the drill-holes ore was discovered at 170 ft. One new shaft will be sunk and the present shaft will be lowered to the 170-ft. level.——A company composed of O. H. and W. H. Picher, Geo. Coburne, J. H. Tonklin, Albert Arnold, and Phillip Janney have purchased the Street mine on the Continental lease west of the city. The mine has developed into a good producer by the discovery of three rich runs of ore. During the development the company will erect a concentrating plant to take the place of the hand-jig plant now in use. The new orebodies contain both galena and zinc-blende.——A heavy deposit of low-grade ore has been opened in the Emperor mine in Gordon Hollow. The deposit extends from a depth of 90 to 140 ft. The upper portion of this deposit consists of a mixture of pyrite and zinc-blende, which when concentrated assays at best only 58% zinc. The deposit, however, is free from gangue, and the mill is taxed to care for the concentrate coming from the jigs. Below the upper portion a second layer of high-grade zinc-blende occurs which is free from pyrite and assays 60% zinc. The mill is a new producer and is turning in a large tonnage of concentrates from a hitherto abandoned camp.——A very rich deposit of galena has been opened in the Water Witch mine in the Kansas City bottom, east of Joplin. The mine was recently re-opened by Chas. Edwards & Co., who discovered the deposit in the eastern edge of the lease.——A new development in the Spring City district, south of Joplin, has been made by the Delta Mining Co. In a shaft at a depth of 180 ft. driving has encountered heavy bodies of blende and calamine, with a little galena intermixed. A heavy volume of water has hindered the opening of the deposit, but since the installation of a heavier pumping plant the work has progressed rapidly. A concentrating plant is now

being erected and will be designed to separate the three minerals and also eliminate the gangue. The plant will handle 200 tons per 10-hr. day.——In the Webb City camp, north of Alba and north of the north fork of Spring river, the Quick Seven Mining Co. has made a new strike of ore in absolutely virgin territory. The strike was made at a depth of only 20 ft. and continued to 60 ft. At a depth of 180 ft. another deposit 20 ft. thick was penetrated. Two holes have shown the same record, but a number of other holes will be drilled before sinking any shafts.——South of Duenweg, on the Schifferdecker land, Congdon, Smith & Co. have undertaken the re-opening of a rich tract recently lost on account of the shafts being flooded with high waters. A heavy pumping plant is being installed. The company was formerly taking out a good quality of free ore and concentrating it upon hand jigs. The ore occurs at 60, 80, and 120-ft. levels. The ore is galena and zinc-blende.—— The Aledo Mining Co. at Duenweg, entered the list of producers from that camp the past week. This company has developed a mine on the Hall land and has opened a good body of milling ore at 180 ft. A concentrating plant has been erected and the first ore was 40 tons of concentrate running 60% zinc.

Joplin, May 11.

NEVADA.

CHURCHILL COUNTY.

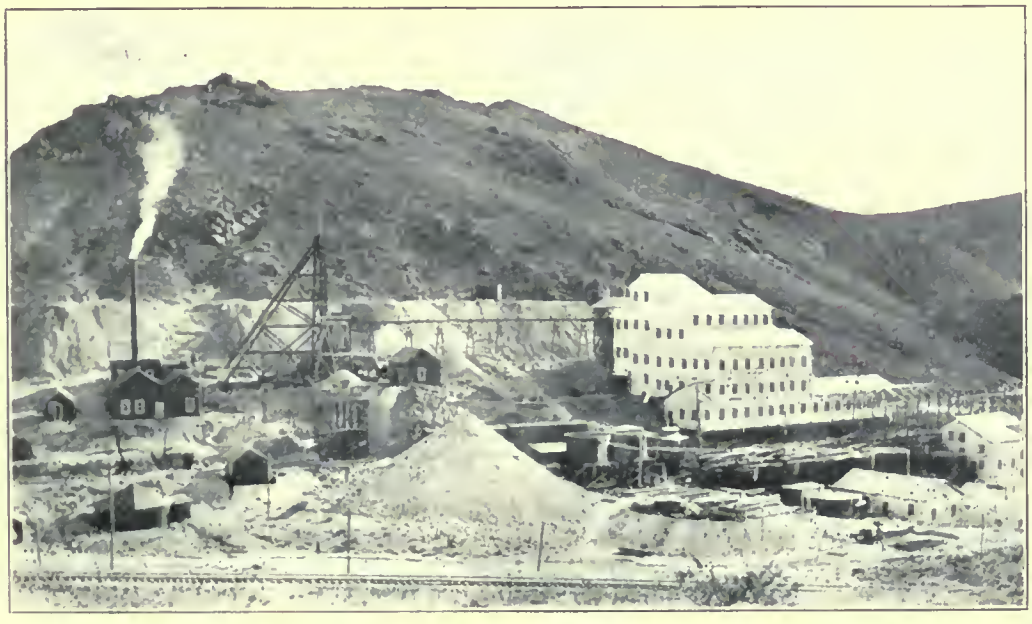
The I. X. L. mine, in the western part of Wonder district, is again shipping ore. A 4-ton lot sent to the Hazen sampling works yielded returns, as reported, of nearly $5000. ——The miners in the Fairview district have accepted the Tonopah scale of wages. This will probably mean that a number of the properties in that district which have been inactive for some time will be opened.

ESMERALDA COUNTY.

A strike of importance to Goldfield is reported at the Mohawk. In cross-cutting toward the Jumbo territory on the 600-ft. level a body of ore was cut which is 19 ft. thick and assays $65 per ton. This strike is of significance in showing that the rich ores in the Goldfield district are not only at the surface.——The Florence Extension has cut a good body of ore 5 ft. thick, which is probably the Little Florence lode.——The Thomas lease on the Combination No. 3 is being put in shape for active development. The shaft is being enlarged and a head-frame erected. A 30-hp. electric hoist will be installed and the shaft sunk to the 500-ft. level. Oswald Stein is manager.——The concrete work for the new Combination mill is almost completed, and the erection of superstructure and machinery will start soon.—— The 40-hp. hoist for the Grutt Syndicate arrived at Rawhide last week and will be operated as soon as the head-frame is completed.——The total shipments from Goldfield for the week ending May 9 were 1715 tons, valued at $99,265.

HUMBOLDT COUNTY.

A 10-stamp mill is being installed at the Mountain City mine, in which Goldfield parties have recently become interested. The Little Gladys group is also being steadily developed. A promising vein has been struck in this property. ——The miners' union of the Seven Troughs district has agreed to a wage scale which involves a reduction of from 50 to 75 c. per day from the scale which has been in effect, and precludes the possibility of labor trouble for some time to come. The agreement provides for the following graduated scale of wages: Muckers and top-men, miners, driving and cross-cutting, $4.25; miners, sinking and raising, $4.50; miners, wet-shaft work, $5 (men to furnish their own rubber clothes and boots); engineers and timbermen, $5.——The Imlay Con. Co., four miles southeast of Humboldt House, has made a strike in a 40-ft. drift from the 140-ft. level. Some high-grade ore has been found on the hanging wall that assays $1 per lb. The ore runs 12 to 15 oz. gold and several hundred ounces in silver. The adjoining vein is 8 ft. wide.



Montgomery-Shoshone Mill, at Rhyolite.

NYE COUNTY.

The machinery for the Tonopah Buckeye Mining Co., at Tonopah, has arrived and will be taken to the property and installed as soon as possible. The outfit consists of a 44-hp. hoist and the most up-to-date operating necessities. The head-frame at the mine has been placed in shape to receive the cage. With the installment of the machinery, operations will be pushed with greater activity than ever before. ——Rich samples have been found at the Pritchard property on Melklejohn Mtn. near Bullfrog. Eight sets of lessees are developing the claim.——The Homestake has purchased the six-drill compressor plant at the Red Oak property, which will be moved at once and mining operations resumed. All material is on hand for the 25-stamp mill, now under construction, and its completion will be rushed.——Ground has been broken for the custom mill which C. R. Campbell will build in the Bullfrog district.——The Bullfrog Pioneer has received its 15-hp. hoist and it is now being installed. The leasing company will operate the plant as soon as the Huntington mill, which is now on the way, arrives and is set up.——Peter Vuich and Thomas Suraka have taken a one-year lease on a portion of the West Extension property. ——At the Burns-Anglin-Peterson lease on the Capricorn the shaft is being sunk to the 100-ft. level.

Special Correspondence.

LONDON.

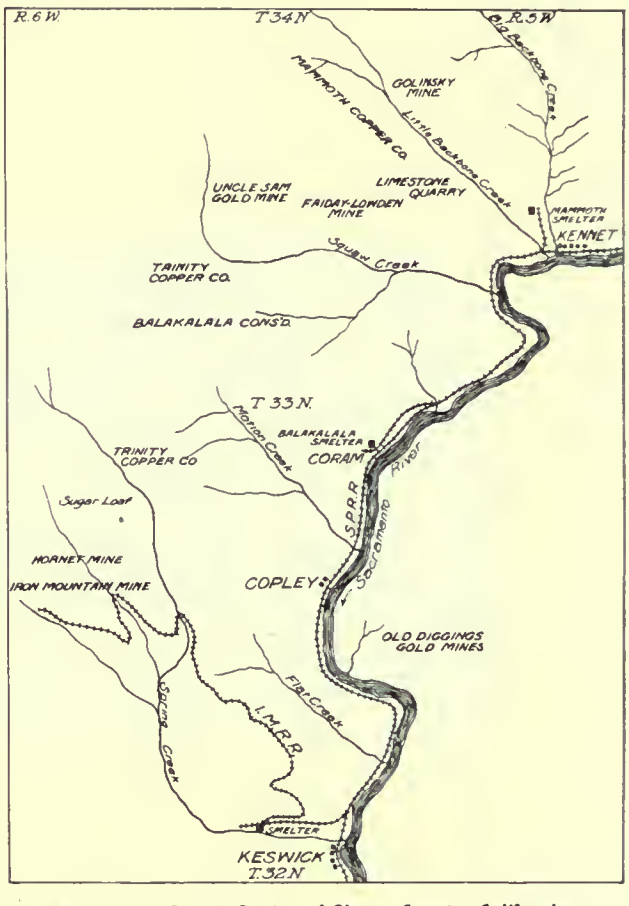
Mountain Copper Co.—Conservative Financiering.—Tharsis Copper Co.—Esperanza Litigation.

When dealing a few weeks ago with the forced reticence of the Rio Tinto Co. with regard to its policy and operations, I mentioned that the Mountain Copper Co. of California, which is under the same control, is equally chary of giving information as to its doings, on account of the annoyance caused by the political blackmailers. It is not surprising therefore to find that the official report for 1907 of the Mountain Copper Co. is exceedingly bare of details. All it says is that 3407 tons of copper were marketed during the year, against 2854 in 1906; that the output of sulphuric acid and fertilizers has been successfully marketed, and that the profit for the year was £150,254. This is all that is said relating to the figures and results, but the directors add a few words as to their policy. During the earlier part of 1907 the prices obtainable for copper were very good. Taking advantage of the higher prices, the company treated as much ore as possible, a fact which accounts for the higher output. I have always said that the Rio Tinto people can guess the future of the copper market better than anybody else. This is certainly a case in point. For the past nine months the output has been restricted until the price goes up again, but, let me add in parenthesis, not restricted to such an extent as to increase the cost of production. The directors have looked closely into costs and they state that it has not been possible to get the cost of labor, supplies, and material to as low a level as was customary in 1904, before the recent great boom in prices and trade occurred. However, with the decrease in employment, labor is becoming more efficient, which will to some extent make amends.

The directors distribute the usual interest on the debentures, but are not redeeming any at present, preferring to keep money in hand. Your readers will remember that the share capital of this company is practically non-existent, amounting to the nominal sum of £20. In 1899, when it was found that the mine was of limited extent, the company was reconstructed and the bulk of the capital converted into redeemable debentures. In other words, £1,250,000 in shares was converted into £250,000 in shares and £1,000,000 in debentures. Only £20 of these shares are issued, the remainder being held for issue at some future time when the debentures are redeemed and new property acquired. So far £250,000 of the debentures have been redeemed. More would have been redeemed if it had not been for the necessity of removing the smelting works from Keswick, and the desirability of extending operations whereby the barren pyrite could be utilized. I desire to call the attention of your readers to this policy of the Mountain Copper Co. of providing for the reduction of capital concurrently with the exhaustion of the mine. Last week I gave some cases of writing down equipment. To be logical, allowances should be made in the balance sheet for the depreciation of the mine as well.

While speaking of this method adopted by the Mountain Copper Co. of writing off the value of the mine as well as of the machinery, it occurs to me that it is opportune to give information about the same policy adopted at two of the copper mines in the south of Spain and Portugal, the San Domingos in Portugal, belonging to Mason & Barry, Ltd., and the Tharsis & Calanas in Spain, belonging to the Tharsis Sulphur & Copper Co. The Mason & Barry Co. was originally formed in 1878, and for a number of years paid good dividends. In 1892, as the limits of the property were ascertained, arrangements were made for writing down the capital from time to time. There were 185,172 issued shares of £5 each, and in 1894, '96, '98, and 1900 a sum of money equal to £1 a share has been returned to the shareholders, and the nominal value of the share reduced accordingly. The issued capital of the company now stands at £185,172 in shares of £1 each. The funds in hand at the present time consist of investments and cash in bank amounting to £173,000. I am not able to say how long the mine will last, but I believe it has several years' life before it still. During 1907, a mining profit of £67,216 was made and dividends absorbing £55,551 were paid, being at the rate of 30 per cent.

The Tharsis Co. was floated in 1866, and its capital has been £1,250,000 since the beginning. The average dividend has been 20%, varying slightly with the fluctuations in the price of copper. These properties have been known to be limited for some time, and yearly sums have been placed aside to accumulate against the depreciation of the mines. In the balance sheet, the property assets consist of mines, railways, works, and so forth, valued at £174,188. The total original cost has been £2,590,254, of which about half was for property and half for plant. The total amount written off to date has been £2,416,065. Of the present value, £174,188, the mines account for only £20,000, the railways in Spain for £64,940, and the plant in Spain and England for £99,248. The other items in the balance sheet consist of £324,065, the value of stocks of ores and metals in the course of treatment, and £1,138,244 in cash and securities. The actual sums distributed as dividends during the 41 years' life of the company total £8,852,182. For the year 1907 the net profit was £292,896, and £250,000 was distributed as dividend. The production of copper during 1907 was 4410, as compared with 4739 tons in the year before, the decrease being due to the gradual reduction in the copper-content. Of this, part was produced on the spot by washing, and the remainder was extracted at the English and Scotch works of the company. The amount of copper precipitate shipped from the mines for refining was 2753 tons, and the pyrite shipped, including washed ore, was 406,015 tons. The recent fall in the price of copper has had little effect so far, as with Scotch shrewdness the directors sell ahead in boom times. What is to be done with the accumulated funds is not yet decided. It has always been the intention to acquire other properties. Recently some prospects in Arizona were taken up, but did not justify further expenditure. The difficulty is that sellers of property always want more than the Tharsis people will give.



Map of the Copper Region of Shasta County, California.

On a big property, the sellers generally offer the Tharsis Co. nothing but smelters' profits and want all the mining profits for themselves. This is of course not enough. The shareholders are quite content with the interest on the accumulated funds, which yield £41,679 a year, until the time comes when a reasonable proposition is put before them by the owners of properties.

A few weeks ago I referred to the case of the San Vicente copper mine in Spain, where the English shareholders were endeavoring to get rid of their liability, owing to the mine not being equal to their expectations. There has been another dispute in connection with an adjoining copper mine also floated recently, namely, the Esperanza. In this case the dispute was the other way round, the vendors, who were debenture holders, alleging that the directors of the English company which had bought the property were not managing the business in a proper way. An application for receivership made on behalf of the debenture holders was not successful, but another action of somewhat similar character has been entered on the lists in the high court. Owing to the case being *sub judice*, I am not able to deal with the subject in the way I should like, and must content myself with bare facts. The difficulties of the company have been several. In the first place the working capital is insufficient, secondly, delays occurred in shipping the ore, and thirdly, the accounts have not been made up as early as they should. The company was formed in February, 1906, and the report was made by Robert Addie, who is well known in the western States of America. The mine was sufficiently far developed for almost immediate shipments. Somehow or other it was not possible to dispose of the shipping ore at first, a fact which showed that arrangements for the sale of the ore had not been made beforehand in the orthodox way through the ore and metal merchants. This has been remedied and the output to the end of 1911 has been contracted for. From February, 1906, to the end of December, 1907, the total shipments of cupriferous pyrite was 57,738 tons, whereas during the first three months of the present year, the shipments had risen to 22,000 tons. Want of capital has militated against progress in many ways, more particularly in the adoption of a leaching process. The company could not afford to lock up the capital involved in this process. The other grievance, relating to the absence of published accounts, has now been removed by the issue of a balance sheet and a profit and loss account to the end of December. Seeing that the profit in Spain, after allowing for depreciation and proportion of mine development, amounted to £24,284, the position of affairs is not quite so bad as might be supposed on hearing that a receiver had been asked for. No doubt the directors in future will be able to assume a more business-like attitude.

BENGUET, P. I.

Mining Association Formed.—Mining Code Drafted.—Bua, Clark, and Camote Properties.—Railroad Development.

Mining in the Philippine Islands has always been hampered and retarded by either a total lack of a proper mining code or a poor set of mining laws. A recent meeting of the Benguet Mining Association proposed to correct this evil by drafting a mining code embodying all the best laws of the United States and Canada. Members of the Philippine Commission had already given assurance that such a set of laws would be passed by them if not in conflict with United States laws. Confirmation by the Philippine Assembly is then all that is necessary to give the Islands as good a set of mining laws as any country in the world. There is no question but that the Assembly will pass upon these laws immediately. Lode claims are limited to 300 meters square (22.23 acres), with no extra-lateral rights.

The Benquet Mining Association has only been in existence three months, but its many good results are already beginning to show. It has made five permanent collections of Benguet ore, one of which was at the Manila carnival. Through its efforts the Mining Bureau has decided to put a corps of engineers at work immediately making a topographical map of the Baguio district. It is intended to get like associations formed in other provinces, with the ultimate object of forming a Philippine Mining Congress with permanent headquarters in Manila.

The Antimok portion of the Baguio district is the most active mining region in the Islands today. Perhaps the strongest company operating there is the Bua, with 40 claims patented. They have just finished a test of their new mill, which will be put in continuous operation in about two weeks, when the tramway from the main mine workings shall have been completed. This mill, driven by a Pelton water-wheel, consists of six quadruple-discharge Hendy stamps, amalgam plates, and complete cyanide plant. The Benguet Consolidated, or Clark's property, consisting of eight claims, adjoins the Bua on the west, and has been turning out a steady stream of bullion with its three Hendy stamps and cyanide plant for the past two years. Three additional stamps are now in place alongside and will start dropping as soon as the slime plant is completed. The slime will be cyanided separately by agitation in tanks fitted with stirrer arms. Finer crushing will then be resorted to, so as to effect an additional saving.

The Camote company, owning a single claim east of the Bua property, is operating a three-stamp mill of the ordinary type with 750-lb. stamps. This mill has neither a rock-breaker nor a cyanide plant, and is only saving about 50%, or about $7 per ton, and crushing two tons per stamp per day. The tailing, however, is being stored, and a modern mill will be installed as soon as development work now progressing shows the true character of the ore, as in depth it is sure to be different from the oxidized surface-ore now being milled. Three main tunnels at 50-ft. intervals are being driven ahead on the vein with all possible speed. These three properties are east of Baguio six miles, while to the southeast about the same distance is the Murphy property, also a producer. The mill here consists of screens and an amalgam plant which treats less than two tons per day. The Major Mining Co., operating between the Murphy property and Antimok, is about to install a small experimental mill. This property was only located last November. More development work is now going on in the Province than ever before, and new strikes are being reported daily.

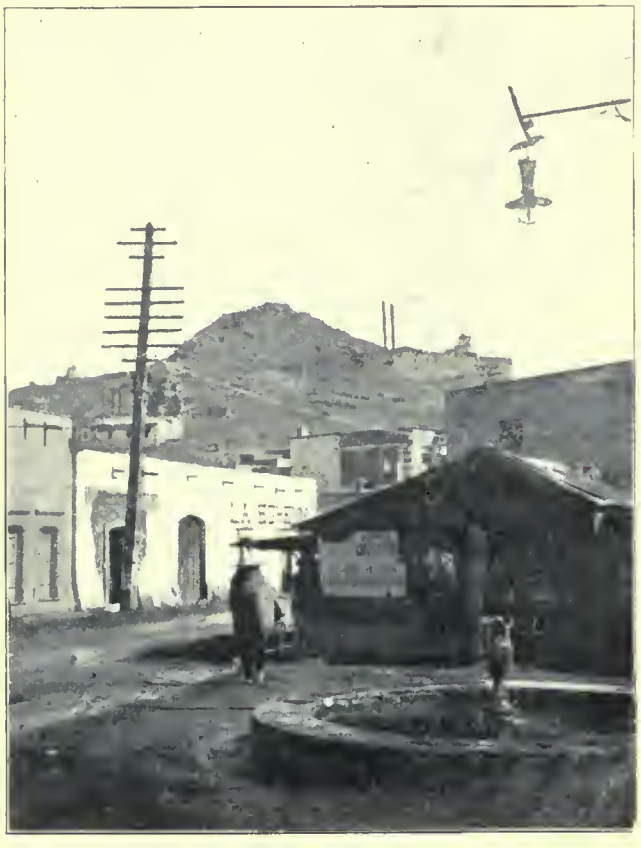
Transportation has been a serious problem and has retarded mining and all other industries here. The bridges on the Benguet road cannot carry a piece of machinery weighing over 3000 lb. Trains have just started running into Camp 1, which is within twenty miles of Baguio, the capital and main distributing point for the Province. This shortens the bull-cart haul 30 miles and places Baguio within a day's journey of Manila. An electric road is now assured from Camp 1 to Baguio, the grades being too heavy for steam. The steep mountains here will furnish plenty of water-power for electric generation. There is some promise of a smelter in the near future, as a representative of the United States Smelting, Refining & Mining Co. has been here for the past five months examining copper and gold properties.

MEXICO.

Discoveries at Parral.—San Francisco del Oro.—Activity at Santa Eulalia.—A. S. & R. Co. Smelter at Chihuahua.—La Republica.

It is with genuine pleasure that we note in the State of Chihuahua a revival of interest in mining and an awakening from the lethargic conditions so widespread last fall. The most promising strike for years past is that made in the latter part of April by Antonio Morales, a poor ranchman, in the Parral district, only a short distance from Parral. The first trial shipments of two lots, making a carload altogether, to the American Smelting & Refining Co.'s agency at Parral give returns respectively of 150 oz. and 800 oz. silver, and $^{1}/_{10}$ oz. and $^{1}/_{4}$ oz. gold per ton, and Morales is already spoken of as a second Pedro Alvarado. A great rush for denouncements was immediately made, and already the holdings of Morales are completely surrounded by new locations, among the largest number having been made by Bert Peterson, one of the most successful

operators in the Parral district. On the west side of Parral the San Francisco del Oro Mining Co. has completed its 50-ton experimental mill, under charge of the Minerals Separation Co. of London, which holds the foreign patents for the Sutton-Steele dry-concentrating tables and the Sutton-Steele static separator; and in addition to this the company is preparing to resume shipments of its clean high-grade ores. At the Cigarrero property, east of Parral, in the Almoloya district, another rich strike of copper ore running over 100 oz. silver has just been reported, but the rich owner of this property is making small shipments, waiting for a rise in the price of metals. At the same time he is opening up his already large orebodies. Almost adjoining the Cigarrero lies the Guadalupe, which has just been taken over by W. D. Pearce, resident manager for the Mexican Mines Corporation of New York, under a bond given about one year ago. During that time the company has opened up good bodies of ore running as high as 36%



Santa Cruz Hill, Parral, Mexico.

copper. The Mexican Rica Mole Mining Co., with a capital of $2,000,000, subscribed in Denver, and the El Porvenir Mining Co., with $3,500,000 of Paris and Denver capital, both with about 25 pertenencias (about 60 acres) near Parral, under the charge of Nat. P. Wilson, are working in good ore and are making preparations for ore shipment. In the Santa Eulalia district, near the city of Chihuahua, C. O'Callahan has started shipment from the new orebodies in the Santander and the San Antonio Chico, comprising some 100 pertenencias, in which the ore is now being developed, were dropped out by the Santa Eulalia Exploration Co. (Buena Tierra) from the ground purchased by that company from Mr. O'Callahan about two years ago. In addition to this, it is stated that L. M. Terry has run into a good body of ore in the Inglaterra, that R. J. de Morambert has found the ore in the Florencia, and that on the El Cristo a remarkably high-grade lead and silver ore has been found. The report is current that Chas. M. Schwab has made a payment in the New York offices of the Chihuahua Mining Co. for an extension of his option on the properties of the Chihuahua and Potosi mining companies. Orders have been sent from the headquarters of the American Smelting & Refining Co. to prepare the Chihuahua smelter so that operations may be begun soon after June 1, and ore is now being diverted to that plant. It is an entirely new plant, and has never been in blast, though practically completed (at least three of the six furnaces) last November, with the intention of blowing in during January of this year, but the falling off in the ore production throughout Mexico because of the prevailing low prices for metals caused the cessation of this construction work about February 1. Now it is understood there will be a sudden renewal of activity, but what has occasioned it, whether it be the requirements of the company's concession from the State, or the knowledge of some new source of ore supply, or some deeper motive, cannot be determined; certain, however, it is that the blowing in of the Chihuahua plant of the American Smelting & Refining Co. will bring relief to many, arouse new hope in others, and to all throughout the State of Chihuahua, whether directly or indirectly interested, it will appear as a sign that improved conditions are at hand.

The latest news from the Republica mine is very encouraging. The cyanide mill is now in regular operation. The tube-mill crushes all the ore to finer than 150-mesh and the first experimental run of the cyanide tanks gave an extraction of 80%. If any difficulty is experienced in the freighting of silver concentrates from the mine to the railroad these will also be cyanided, with the exception of the first streak on the tables, which runs over 2000 oz. silver per ton. This rich concentrate will not exceed 10 tons per month. The ore on the 300-ft. level is still looking extremely well. The level is now 111 ft. long; the average width of the vein is approximately 12 ft., with the ore assaying 175 oz. silver per ton as a general average throughout. The surface holdings at the mine have been increased from 166 to 366 acres, and now cover more than 8000 ft. on the outcrop of the vein. The company will ultimately increase the number of stamps in the mill from 10 to 15, and later on to 40. The tube-mill has been built to slime from 1200 to 1500 tons of ore per month, while the present stamping capacity is only 700 tons per month. There remains blocked out in the mine over 41,000 tons of ore immediately available. In addition, the faces of the exploration levels are still in high-grade ore. In sinking the main shaft to the 400-ft. level a small stream of water was cut when the vein was reached. A regular station pump will be installed at the 300-ft. level.

ROSSLAND, BRITISH COLUMBIA.

Blue Bird.—Centre Star Shipments.—Diamond-Drilling at Phoenix.—Devlin Group.

Mining in Rossland still continues to look promising. The large mines are pushing development and shipping a regular quantity of ore every week. Among the South Belt prospects the Blue Bird is still showing up well. L. Carter of Spokane states that the Blue Bird company, of which he is president, will operate the property after the expiration of the present lease, on December 6. The lessees of the Mayflower are taking out ore, and a copper orebody has been found on the Nest Egg. Several other claims have been leased and staked. The Red Eagle joined the shipping list last week, sending a car of picked ore to Trail smelter. The following ore shipments were made from the camp for the week ending April 25: Centre Star, 3450 tons; Le Roi, 1295; Josie (Le Roi No. 2), 210; Red Eagle, 20; giving a total of 5065 tons. The Centre Star is now the heaviest shipper in the camp. The Trail smelter has contracted for 100 tons of 4% copper ore from the Snowstorm mine in Idaho.

The Granby mines shipped 19,905 tons of ore during the week named above, and treated 19,721 tons at the smelter. This makes a total of 334,810 tons mined and 326,224 tons treated this year to April 25. Phoenix shipments for April will not equal those of March, but the general average is much higher than for either 1906 or 1907. At times only seven furnaces were operated this month, one having shut down most of the time for repairs. Diamond drill has been resumed. The side-dumping five-ton cars on the 400-ft. level are working satisfactorily and will reduce

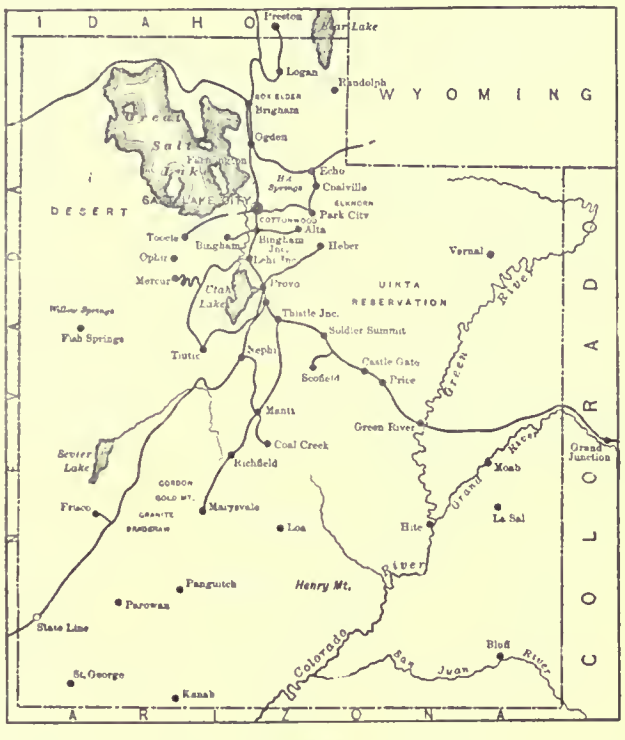
the cost of handling ore on this level. The cars are operated by electric locomotives. Diamond-drill development is in progress on the lower level of the Ymir. The management feels sure that the orebody will be encountered in depth. All that is required is sufficient money to execute needed development. In mining circles here the story is going the rounds that the owner of the Westmount in Slocan developed that property. It is over ten years since he began a 1000-ft. tunnel to tap the lode. Alone in the hills he worked on his claim for months at a time without hearing the voice of a fellow being. Success has now crowned his tenacity of purpose. The last car of ore shipped from the Westmount averaged 405 oz. silver per ton. On the Devlin group, Sheep creek, the lode is showing up 6 ft. wide, carrying $15 in gold per ton. There is a 12-in. paystreak on the hanging wall carrying $100 per ton. The Silver Cup is to be developed by a tunnel 400 ft. lower down than any existing adit.

SALT LAKE, UTAH.

Yampa Mine.—Methods of Mining a Wide Vein.—Consolidation of Tintic Mines.—Increased Ore Shipments.—Ontario Drainage Adit Restored.—Conditions at Park City Improving.

The Yampa mine of the Tintic Mining & Development Co., situated in Bingham canyon, requires thorough timbering. The company buys its timbers for square sets already framed, and it is stated that the cost in this form does not exceed that of timbers in the rough when the cost of framing on the ground is added. At the upper tramway terminal new 600-ton bins have been erected. The aerial tramway, two miles long, delivers the ore to the company's smelter. Between 400 and 500 tons of ore per day are now being moved. The converters now being installed will be ready for work within about six weeks. A new Ingersoll-Rand air-compressor has been installed at the mine. The compressor is driven by and is direct-connected to an alternating induction-motor, rated at 300 hp., operating at 145 rev. per. min., and has sufficient capacity to operate 35 air-drills. The drill-sharpener, of the Numa type, in the blacksmith shop, will sharpen 300 drills per day. The compressor-room, tramway terminal, blacksmith shop, and offices are near the portal of the main haulage adit, which penetrates 3000 ft., to a point where it intersects the Yampa vein. The ore is hauled out in trains of six 3-ton cars by electric locomotives. One locomotive is a 5-ton Jeffrey and the other a 3½-ton General Electric. Where the main adit encounters the vein a branch track leads 200 or 300 ft. straight ahead into the quartzite foot-wall to the 600-ton loading bins, which receive the ore from the eight working levels above. Another branch from the point named is a drift on the vein, extending between 500 and 600 ft. along the strike. The vein, which occurs along the contact of quartzite and limestone, has a dip of about 26° to the north. The ore consists of a clean heavy iron-copper sulphide, penetrating both the lime and quartzite. Above the haulage adit are 12 levels, 8 of which are now active. At a point in the main adit 3500 ft. from the portal is the base of a new incline which extends up to the 400-ft. level, keeping between the walls of the vein. This incline is double-tracked, a 5-ton skip operating on each track and dumping ore into chutes on the 1100-ft. level. These lead into the main ore-bins on the 1200-ft. level, which is the main adit. The work of driving and stoping goes ahead on both sides of this incline, the ore being dumped from cars on each level into skip-pockets, the latter discharging into the skips that move on the incline-tracks. These skips are operated by an electric hoist situated at the head of the incline on the 400-ft. level. The great width of the vein and the regularity of the dip are remarkable. The method of mining is to break down the ore and put in square sets, advancing a breast of three sets wide from wall to wall. As illustrating the width of the vein it is observed that in some places it requires 27 sets horizontally to fill the space between walls. On some of the levels the ore mined on the strike of the vein shows a length of 80 square sets. There is but little waste rock between the walls and the practice is to mine and send all the vein-matter to the smelter. The deposits on the lower levels, that is, from the No. 8 to the No. 12, are wider and of better grade than were those on the higher levels. On the operating force of the Yampa are the following: J. C. Dick, general superintendent; N. Treloar, mine superintendent; E. E. Price, mine foreman; G. W. Metcalfe, smelter superintendent.

A consolidation of the Swansea and South Swansea mines, in Tintic, has been arranged and special shareholders' meetings have been called to ratify the deal, and to organize a new company, to be known as the Swansea Consolidated. It will be capitalized for 1,000,000 shares, 300,000 of which will be issued to shareholders of the Swansea and South Swansea companies, the balance going into the treasury to be disposed of as the board of directors may deem best. The Bullock Mining & Milling Co., operating in Tintic, has purchased six additional mining claims to be paid for in stock, which is to be obtained by increasing the capital from 300,000 to 600,000 shares. The vendors will get 125,000 shares, the remaining 175,000 shares going



Utah.

into the treasury. The Bullock is one of the new producers of Tintic. Ore shipments from Tintic last week amounted to 67 carloads, the contributing mines and amounts being: Bullion Beck, 3; Centennial Eureka, 46; Eureka Hill, 10; May Day, 4; Yankee Con., 4. The ores from the latter are shipped to Salida, Colo., and the Centennial Eureka product goes to Kennett, Cal. The Carisa Mining Co., of Tintic, has arranged to ship its ore to the Yampa smelter in Bingham canyon for treatment. The Grand Central mine at Tintic has resumed operation after a shut-down of about five months. Ore shipments will begin to the Tintic smelter about May 15, on which date the ore purchasing department of the new smelter will be ready for business.

The Ontario drain adit at Park City has been restored. At least the water in the workings of the Ontario mine has been lowered to the adit level, and the management will probably know in a few days how seriously the three years of inundation has damaged the levels from which ore was being extracted prior to the disaster resulting in the caving-in of the avenue in March, 1905. Almost from the very day it happened the work of restoring it has been under way. The task has been a dangerous one, but the records show that only one fatality has occurred, and that was due to no fault of the employers. When the accident happened it was thought the trouble would soon be over-

come, that the timbers had given way only at one weak spot which was then being repaired. Subsequent development proved that a series of caves had occurred, and that it might take months or years to remove them. Such has been the case, and whenever an obstruction was encountered parallel drifts were run around them, the extent of the caves being determined by means of drill-holes run in to the main avenue from time to time. The Ontario drain adit was located in 1888. Work was begun on July 25 of the same year, and completed to an intersection with the 1500-ft. level of Ontario No. 2 shaft, a distance of 15,494 ft., on October 7, 1894. The cost of this section of the adit was $671,011, the expense being borne jointly by the Ontario and Daly mining companies. The present length of the adit is about 25,000 ft., having been extended from Ontario No. 2 shaft to the boundary of and across the Daly company's property into the Daly West ground. The importance of the Ontario adit is emphasized by the fact that since it has been obstructed, it has been impossible to operate the lower levels of nearly all the producing mines in the Park City district, the mines most seriously affected being the Ontario, Daly, Daly West, Silver King, and American Flag. Consequently, plans that had been outlined to explore them at greater depth were frustrated for the time being. The Daly West and Silver King then confined their operations to the ore deposits near the surface, as did the American Flag; but the Ontario and Daly mines closed down tight. During the past year the Silver King and Daly West have not kept up steady production, and their annual reports show that the output has gradually decreased from the date of the disaster. Likewise, dividends have been either reduced or suspended. None of the Park City mines are paying dividends now, but the re-opening of the adit will bring about a return of old time conditions. The camp has already begun to feel the effect of the restoration of the adit. The outlook for the camp is bright, and on the local mining exchange the daily quotations and sales show that interest is being revived in Park City stocks. Development work has been resumed at the Uintah Treasure property at Park City.

BUTTE, MONTANA.

British-Butte.—Placer Against Quartz Claim.—North Butte Extension.—Heinze's Difficulties.

The application of the British Butte Mining Co. for patents on about 1000 acres of placer ground just west of the city of Butte, is being opposed by Government agents, and for some time several referees have been engaged in taking testimony in Butte. The company has for more than a year been engaged in opening the ground preliminary to extensive placer mining by means of dredges and cyaniding, and to a depth of about 750 ft. the ground has been sampled and tested every two feet. Not a single blank test or sample was found throughout that depth, and in the underground cross-cuts assays show from 50c. to $24 per ton in gold. However, special agents of the Government, who claim to be mineral experts, have testified before the referees that the ground is valuable only as agricultural land, and does not contain gold. It has been the testimony of placer miners for 30 or 40 years that gold could be found in any spot over a vast territory west of Butte.

A suit of the South Butte Mining Co. against the East Butte Mining Co. and a number of the latter's lessees, for $100,000 damages on account of ore alleged to have been mined from fourteen one hundredths of an acre of ground embraced within a Great Northern railway right of way, the mineral rights to which the railroad company assigned to the South Butte Co., has been tried and submitted to Judge Bourquin for decision. The East Butte Co. owns the Oneida, a quartz location, which covers the small tract in question, and asserts title through that, while the South Butte claims under a placer title. The ground is outside the original East Butte territory, and the latter company did not assert its quartz title until forced to do so by the action of the South Butte, and the controversy resulted in a contest between quartz and placer rights. The South Butte has two claims for ore aggregating $400,000, but its own evidence at the trial showed that the total net value of the ore mined was less than $18,000. If the East Butte wins on its quartz location it will be a very important victory, as the Oneida not only covers the small bit of ground claimed by the South Butte, but also much valuable mineral ground, held under placer patents, and owned by the Amalgamated Copper Company.

F. A. Heinze is reported to have disposed of his controlling interest in the Stewart mine. It is said that those now in control of the property are preparing to resume operations. Both the Basin Reduction Co. and La France Copper Co., Heinze corporations, appear to be pressed for money, as recent checks of the Basin Co. were held up for lack of funds at the bank on which they were drawn. The La France has not paid wages for more than two months.

TORONTO, CANADA.

Opposition Interpellates Government on Yukon Gold.—Status of Yukon Holdings.

In the Canadian Parliament on May 4 Frank Oliver, Minister of the Interior, replied at length to a series of questions put by Claude Macdonell, representative of South Toronto, as to the flotation of the stock of the Yukon Gold Co. by Thomas W. Lawson and the actual status of that concern. The answers were principally noticeable for the lack of any definite information held by the Government on this subject, but some important points were cleared up. Mr. Oliver replied that the Yukon company holds placer-mining claims on the Bonanza, Eldorado, Bear, and Bunker creeks, but that as no record of production by creeks had been kept, the Government was not able to corroborate the statement that these claims had a production-record of approximately $100,000,000. Neither could they tell the area of the company's holdings, as many of their claims had not been surveyed, and they varied in size according to the regulations under which they had been acquired. The title to the claims was conditional on the performance of work to the value of $200 and the payment of a renewal fee of $15 upon each claim every year—which statement is in flat contradiction to the company's claim of absolute ownership. The Minister further stated that the total number of claims acquired by the Yukon company appeared to be 820. There is a serious discrepancy in this statement as compared with other official information recently issued by the Department of the Interior. A report on conditions in the Yukon prepared by A. H. Rowatt, embodying data obtained on a visit to the territory last fall, and bearing date September 30, states that the Yukon company had then acquired about 950 claims on the creeks mentioned.

Asked if the Yukon company had acquired the Treadgold concession, Mr. Oliver replied that he did not clearly understand the question, but that if it had reference to a right once granted to Messrs. Ewing, Treadgold, and Barwick to acquire reverted or abandoned claims, which right was afterward rescinded, his answer was "No." The Government, he went on to say, had no information as to statements appearing in the Lawson advertisements, had taken no steps to warn investors, and had had no communication of any kind with Lawson or any member of the Guggenheim syndicate with reference to the acquisition of claims. In answer to a question whether the Government was aware that the company was capitalized at $17,500,000, and that the public had subscribed for shares on the faith of statements as to the absolute ownership of claims by them, all that the Minister had to say was that as the company appeared to be operating under a local ordinance, no doubt a statement as to the amount of capitalization had been filed with the Territorial Government.

The *Canadian Mining Journal* of Toronto, which was instrumental in the suppression of local wild-cat enterprises, announces that a charge of violating the provisions of the Ontario Companies Act in connection with the Yukon flotation will be brought against the promoters.

Concentrates.

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

Glass grit for grinding valve-seats can be made without danger to the eyes by hammering the glass in an envelope of old roofing tin.

Mercury may be easily scooped up with a card or envelope if a wet ring is first made around it on the table or floor where it is spilled.

Metric screw threads may be cut on lathes with inch-divided leading-screws, by the use of change-wheels with 50 and 127 teeth, since 127 cm. equal 50 inches.

Cement for cloth or leather may be made of 16 parts gutta-percha, 4 india rubber, 2 pitch, 1 shellac, 2 linseed oil. Melt together, mix thoroughly, and apply hot.

Taps broken off in castings may be removed if dilute hydrochloric acid is poured into the hole and allowed to remain about four minutes. Enough of the tap and casting are eaten away to loosen the tap.

Fine metalliferous mineral particles in suspension, which often present serious difficulties in settling, may be separated readily by passing the slime-bearing waters through compartments similar to those in the zinc-boxes used in cyanide plants, filled with coke.

Boiler scale may sometimes be prevented by putting granulated zinc in the boiler. The action appears to be an electrical one, the iron being one pole of the battery and the zinc being the other. The hydrogen goes to the iron shell and escapes as a gas into the steam, while the oxygen goes to the zinc.

Titanium-steel alloy may be produced, according to A. J. Rossi, by covering the steel with a blanket of slag, such as that from an ordinary iron blast-furnace. A suitable composition is 40% silica, 15% alumina, 35% lime, and 10% magnesia, or the slag may advantageously contain up to 25% titanic acid.

Ozokerite, one of the bitumen series, is a mineral grading from yellow to a dark brown and sometimes greenish, and may be considered as an altered form of petroleum, robbed of its volatile substance. It is used chiefly as a substitute for beeswax in the manufacture of candles, and as an insulating material in electrical machinery.

Lubricating oil should have the following qualities: 'body' enough to prevent the surfaces to which it is applied from coming in contact with each other; freedom from corrosive acid; as much fluidity as is consistent with proper 'body'; minimum frictional resistance; high flash and burning points; freedom from materials liable to produce oxidation or gumming.

The cement mill at Roosevelt, Arizona, operated by the U. S. Reelamation Service to supply cement for the construction of the Roosevelt dam, produced 10,614 bbl. of cement in February, at a unit cost of $1.81 per barrel. In comparing this cost with the price at which cement could be purehased, it should be borne in mind that there should be added to the latter the cost of freight to the nearest railroad station and the cost of the long team haul to the dam.

Decay of stone due to the action of sulphuric acid in gases escaping into the atmosphere, may be remedied by the use of baryta. The easiest way of applying this earthy base is in the form of baryta water. The dust and loose particles of stone should be removed from the surface to be treated by means of a jet of air. The baryta should be sprayed on at intervals of two or three days until the stonework has beeome hard enough to bear the application of a paint brush freely charged with baryta water. The work must be done in hot summer weather, and the solution will then penetrate a considerable depth in porous stones, after eight or nine applications. About one gallon of baryta water is required for each treatment for 20 superficial yards. Baryta water is poisonous, and precautions should be taken to protect the workmen.

Gold may not only be locked up from the action of mercury by lubricating oil, preventing amalgamation, but oils present in the ore will also hinder solution of the precious metal by cyanide. Duncan Simpson recently showed that in cases when extraction by cyanide had fallen off, it was sometimes possible to leach out a substance resembling vaseline by washing a sample with ether, after which further treatment with cyanide would yield additional large extraction of the gold-content. There are no cheap solvents for the modern lubricating oils. The use of cyanide and caustic soda to cut them is a relic of olden days when lubricants were largely made from organic fats, which are saponified by strong alkalies. The only resource for the modern metallurgist is to absolutely prevent oils getting into the ore.

Tellurium is difficult to detect with certainty when present in small quantity in ores, except by refined methods of analysis. The simple tests described in the textbooks require that particles of the suspected mineral of appreciable size be used. Messrs. Holloway and Pearse describe, to the Institution of Mining and Metallurgy, a new method which they have shown will enable tellurium in minute quantities to be revealed. The ore is crushed and mixed as for an ordinary assay and fused. The resulting lead button is dissolved in dilute nitric acid, and the filtered solution further diluted. A piece of bright sheet-lead placed in this solution will soon become blackened from the deposition of tellurium, which may be rubbed off and put into concentrated sulphuric acid in which a scrap of tin foil has been placed. On heating to the boiling point a carmine coloration in the solution demonstrates the presence of tellurium. The color disappears on cooling, but will reappear on again heating.

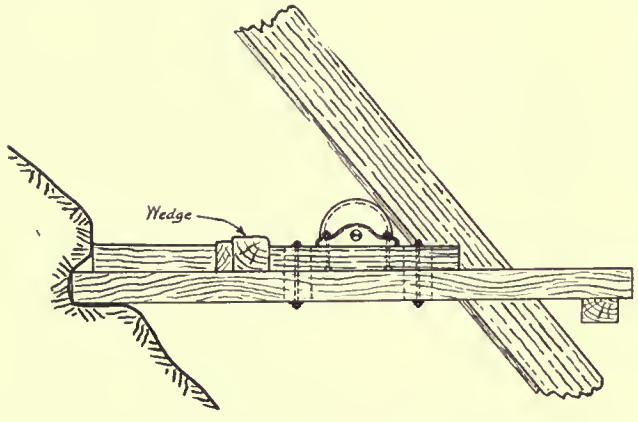
Discussion.

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy.

A Handy Roller for Pump-Rod.

The Editor:

Sir—Some time ago it became my lot to look after a line of Cornish pumps. After going over the line a few times I discovered some of the rollers running light, others running only on the down stroke, the lining being scarcely worn, and others carrying a heavy strain. Also in case of changing a lining I found it necessary to have a jack-screw to do so. The shaft was an incline varying from 70 to 50° for a distance of 1000 ft. Each roller was set in a cast-iron box and babbitted. The stay to carry the roller



was a piece of 4 by 6 in. on its edge, the boxes being bolted to the stays, which made them stationary.

After getting an extra pair of boxes and letting them into a piece of 4 by 4 by 30 in., I then bolted them to make them solid with the piece, as shown in the sketch. By cutting a hole near each end about 4 in. long and 1 in. wide for a ⅞-in. bolt, I made an adjustable box, strengthened by placing a block behind it set back against the ground, and spiked to the stay, with a wedge between the block and the box. The only tool necessary for setting a roller or changing a lining is a wrench to loosen or tighten the nuts on the long bolts. It could also be used to tighten the wedges when setting the roller or to knock them out to slide the roller back to change a lining.

A. MARTIN.

Silver Plume, Colorado, March 23.

Sodium Cyanide.

The Editor:

Sir—The article on 'Passivity of Gold' in your issne of March 28, agrees with our experience at this plant with the two forms of commercial cyanide containing, respectively, potassium, 98 to 99%, and sodium, 125%. The question to a mill man is as follows: When he buys sodium cyanide, having in view the lesser bulk and consequent cheaper freight rate, does he actually have an excess of 25% in efficiency over the old form of potassium cyanide.

In the cyanide department of the Daly Reduction Co.'s mill, the average consumption of sodium cyanide during a period of five months was 1.35 lb. per ton of ore treated, or in terms of potassium cyanide, 1.69 lb. per ton. Trouble was found in bringing up the working mill-solutions to the desired strength, by the addition of the calculated required amount of sodium cyanide. Clean laboratory solutions of sodium cyanide titrated correctly, showing that the salt was of required purity. In the working mill-solutions, however, it was constantly necessary to add an excess of sodium cyanide above the calculated amount, to obtain the desired strength of solution..

We changed to potassium cyanide. At the present time, and after a period covering seven months, the average consumption of this salt is 1.46 lb. per ton of ore treated, or a saving over the sodium cyanide of 4 cents per ton of ore, in terms of the prices at this place. This result has been reached with the same class of ore in each case, and with the same percentage of protective alkali.

With sodium cyanide solutions, the zinc-boxes were troublesome. The zinc coated badly, and after a short time action ceased, making frequent clean-ups and washing necessary. With the closest attention our sump solutions averaged 20 cents per ton in gold. With potassium cyanide, the zinc-boxes are not uncovered more than five times a month, and an average sump solution is not in excess of 6 cents per ton.

The above has held true to a greater or less degree with ores previously encountered at Gould, Montana, and at Zortman, Montana.

E. A. HOLBROOK.

Hedley, B. C., April 13.

Cyaniding Mill Pulp After Amalgamation.

The Editor:

Sir—The examination of an average pulp produced after preliminary crushing in stamp-batteries or other mills, after it has been treated by plate amalgamation, would prove that the different sizes vary as regards specific gravity and mineral composition, as they are known to do in values. In one case the following averages of sizing tests of daily samples, representing a period of 14 days, are given. The pulp after amalgamation was sized, and each size assayed, with the following results:

Mesh.	Per cent.	Dwt. fine gold.
+ 60	14.6	8.8
+ 90	16.5	7.9
+ 100	5.8	4.5
+ 150	8.5	2.9
− 150	54.6	1.2

In other words, 54.5%, or more than half, of this pulp contained only 1.3 dwt. gold. The whole was roughly classified, the coarse product re-ground and finally everything was discharged as a so-called slime into vats for cyanide treatment. The cost apparently did not justify cyaniding 1.3 dwt. product, and it was found that much visible gold, escaping amalgamation, could be arrested on blankets. These blankets were strips, 12 in. wide, fixed upon the lower ends of the plates. Possibly by careful classification, a large percentage of the total tonnage of the finest slime carrying low value, might be eliminated and treated by blanket strakes, slime tables, or automatic

frames, and thus a considerable percentage of the gold in these slimes might be caught inexpensively. The tank capacity available for cyaniding in an all-sliming process would be capable of meeting the requirements of a larger output than was at first intended without incurring the extra expense of enlarging the cyanide department. I think the difference between the first slime produced in a mill and that subsequently obtained by re-grinding is often overlooked. They are really so different that they warrant independent study. In the first instance the softer and more readily pulverized rock constituents, namely, pyrites, aluminous earths, etc., predominate while the portion re-ground has a different character and is more silicious. The question is, whether in an all-sliming process, first slimes are worth cyaniding in every case.

CYRIL E. PARSONS.

London, March 7.

Theory.

The Editor:

Sir—The word 'theory' has been so often loosely bandied about both in connection with mining training and mining work, that I venture to hope that you will find room for a few remarks about the word and its usage.

"Theory," writes John Stuart Mill—and his remarks are so pertinent that they are worth quoting in full—"in its most proper acceptation means the completed result of philosophical induction from experience. In that sense there are erroneous as well as true theories, for induction may be incorrectly performed, but theory is the necessary result of knowing anything of a subject and having put one's knowledge into the form of general propositions for the guidance of practice. In another and a more vulgar sense, theory means any mere fiction of the imagination, endeavoring to conceive how a thing may possibly have been produced instead of examining how it was produced. In this sense only are theory and theorists unsafe guides, but because of this, ridicule or discredit is often attached to theory in its proper sense."

This misconception of the word 'theory' is a common error of the ostentatiously practical school of mining engineers. It is therefore as well to point out that, though *all* theorize in a sense, theorizing in the right sense as described above is usually only the privilege of the trained; while "fictions of the imagination" are the universal heritage of the untaught, so much so that the words 'ignorance' and 'superstition' are readily associated together.

There are at least two reasons for this. In the first place, it is natural to observe incorrectly—there is a tendency for observations to be obscured by inferences, and an uncultivated mind finds it difficult to discriminate between what is inference and what is fact. As a general rule it requires training to do this with efficiency. It is true that many men are naturally clearer observers than others. The artist is a man who has an unusual power of reproducing clearly his observations of form and color, but even he usually finds it advisable to undergo some training in anatomy to correct his impressions of the human figure, one of the commonest objects of his vision.

As a rule, it may be said, the more uncultivated the observer the more unreliable are his observations. "The simplest narrative," says Dugald Stewart, "of the illiterate observer involves more or less of a hypothesis; nay, in general it will be found that in proportion to his ignorance the greater the number of conjectural principles involved in his statements." Secondly, it is difficult for an untrained mind to make correct deductions from observations. One finds such deductions as this: The main reef is rich at Reeftown. This property contains the main reef, therefore this is a rich property.

Such generalizations are becoming rarer, owing to scientific methods of sampling and the application of sound 'theory' to the results obtained therefrom. Another source of error in uninstructed minds is the attempt so often made to explain complicated phenomena by a "simpler explanation than their nature admits of."

One way of learning to observe and to think correctly is by associating with those who do so. A young engineer, starting his career by going into the field, is fortunate if he gets apprenticed to such a man, for it depends largely upon those he is taught by whether he learns sound theory or merely acquires a more vivid imagination. On the other hand, at a good mining school, instruction in the art of observing and thinking are afforded from the outset, and the students at such institutions are brought into contact with men of scientific education who theorize only in the best sense of the word and have the knowledge and ability to clear away "fictions of the imagination." Do not therefore let us give a wrong interpretation to this word 'theory' as applied to the teaching of science; and if scientific theory should at any time appear to be mere fiction, let us remember that the savage thinks the world is flat and the uninstructed observer still thinks that he sees the sun rising and setting and the stars revolving in circles round the pole.

MUNGO PARK.

Menai Bridge, North Wales, March 14.

Mill-Tests.

The Editor:

Sir—I notice in your issue of March 28, that Mr. Mark R. Lamb comments on the statement I made in an article published by you on January 25, in which it was stated that the results of preliminary tests made on small quantities of ore rarely differ more than 5% from those obtained from testing larger quantities, or in other words from 'mill-tests,' and that for this reason he is of the opinion that the mill-tests are unnecessary, the results obtained from them not doing justice to the ore, for the reason that "the larger or mill tests bear very close resemblance to the first few days' run of a new plant, when the best results are rarely expected and never obtained."

While agreeing with Mr. Lamb in the main, I think he rather overstates his case, as there appears to me a large difference between running a carload of ore

through a testing plant, the proper adjustment of which has been determined by careful preliminary work, the machinery and mechanical appliances of which have already been licked into shape by many months and perhaps years of previous running, and last but not least, the testing plant is in charge of a few experienced men who know the plant and its peculiarities from crusher to tailing-launder; as against the starting up of an entirely new equipment that has never been run in unison, by men unfamiliar with eccentricities of the plant and of each other. While it is admitted that the metallurgical results obtained from the small tests furnish data that are reliable; mill-tests furnish mechanical hints that are not procurable from the former. It is an admitted fact that no laboratory crushing can exactly duplicate the product obtained from the Huntington, the Chilean, or the stamp-mill when running under mill-conditions, and it is a wise precaution, before investing thousands in a reduction plant, to see if this difference in crushing makes any material difference in the final results.

The difference in the two classes of test being largely mechanical, it is more prominent in concentration work than in a chemical process, but even in a cyanide test it is well to check the results obtained in the preliminary tests with those obtained from leaching sand to a depth of five feet or more, and from the slime when subjected to actual filter-press treatment. While the preliminary test may satisfy the metallurgist and the mining engineer, it does not often appeal to the operator, or to the man who is putting up the money; nothing appeals to him as much as results obtained from the larger tests, the products of which are obtained from a continuous run, under mill-conditions, and large enough in quantity to be turned into cash.

When deciding upon such an important matter as the correct process and right machinery for converting the product of a mine into dividends, too many precautions can hardly be taken in gathering the necessary metallurgical and mechanical data. It therefore appears to me that before a plant of any magnitude is designed, the mill-test after the preliminary, is almost as important as the preliminary before the mill-test.

ERNEST GAYFORD.

Salt Lake, April 3.

Slime-Filters and Patents.

The Editor:

Sir—In your issue of February 1 you publish a letter written by Mr. Arthur DeWindt Foote; this letter I have carefully perused. He mentions that a friend told him that this process was in use for many years prior to my patent being taken out, for leaching chemicals. I challenge this, and would like the fullest publicity given to this matter. I had never heard of compressed air being used to keep the filtering medium porous, until I used it, and I claim to have originated it. However, of course, I am open to conviction on this point. I may inform your readers that my first experiment was with filter-cloth tied over an ordinary glass funnel, first submitting to a vacuum, and then blowing back, and I gradually elaborated on this until I finally came to the idea of building filtering-compartments in the form of a wheel. If Mr. Foote's friend will be good enough to put in print or refer me to a process using compressed air for the above purposes before I took out my patent, I shall be grateful to him.

ASKIN NICHOLAS.

Stannary Hills, Queensland, April 7.

A Theory of Ore Deposition.

The Editor:

Sir—While at a mine in Oaxaca, I read Mr. Horace V. Winchell's cheerful comments upon my article in your issue of February 22. I have neither the article nor Mr. Winchell's letter with me at present, but feel bound to explain a few points as I recollect them.

The re-arrangement of metals at and near the surface by surface waters, and shallow-seated (vadose) waters derived from the surface, the re-arrangement being due to physical and chemical characteristics such as differences in specific gravity, and in solubility under surficial conditions, is so well known that I have come almost to consider it as axiomatic. I cannot, however, enumerate the various forms of ore deposits thus brought about; but among them come the secondary sulphides, especially important in copper ores, and the secondary lead and zinc carbonates and sulphides, especially important as a result of the alteration of primary mixed galena-blende-pyrite deposits.

But my studies have lately brought me to believe that, save often in the case of the most common metals, these secondary processes operate to concentrate metals already in a state of quite extraordinary concentration. This is commonly accepted in most cases that come to mind; for example, there are few nowadays who, in a rich placer region, do not look confidently for the original source of gold in veins traversing the eroded rocks; or who, on encountering rich carbonates and sulphides of copper near the surface in a given locality, do not look for some impoverishment with increasing depth, as the ore is found nearer and nearer the primary conditions. Yet there are many cases where, if the accessible local conditions alone are studied, the derivation of such secondary ores from primary concentrations is not evident.

I may state in advance that I have come to regard primary ores in general as the result of critical or catastrophic conditions, and have been led far away from the uniformitarian theory of ore deposits which I once regarded with favor. Accordingly, I now look upon primary ores, representing a given stage of ore deposition, as having been formed in most cases within a very brief period of geologic time, and within a limited space or range of distance in which the critical conditions obtained. Hence primary orebodies (including veins) have a top, bottom, and sides. In the case of veins, as is shown at Georgetown, Colorado, the bottom of the vein-filling may be reached, while the strong unfilled fault-channel passes to much greater depths. Erosion may

therefore not be great enough to reveal the top of an orebody; or it may reveal the top, as at Guanajuato in Mexico, in which case relatively deep mining may be possible; or it may have cut down to near the roots of a deposit, in which case a mine is easily bottomed; or it may have cut down below the bottom of a deposit. During this wearing-down process the relative amount of metals carried off by surface waters and mixed with detrital deposits, and of metals carried down and re-deposited in the rocks, often in a concentrated form, depends on several factors, as I have explained in my book 'Geology Applied to Mining.' Under certain conditions a large amount of metals is continually migrating downward, keeping pace with erosion; and this migration may continue after the bottom of the original body has been reached and passed. Such ore deposits may show to the close student evidences of formation largely, almost entirely, or entirely, by descending waters; and where, as in many cases, the ores are associated with an igneous rock containing small quantities of metals similar to those found in the orebody, the conclusion that the descending waters have derived their contents from a disseminated form in the eroded rocks is natural, though I have come to believe it mainly an altogether erroneous one. This applies especially to Monte Cristo, where nearly ten years ago I described the local evidence of the deposition of large quantities of sulphides by descending surface waters. In many of the instances studied or described at Monte Cristo, there appeared to be certainly no root-deposit, and it appeared that the metals were wholly precipitated from descending waters; and since this evidence was all that there was obtainable, I stated, though without assurance, the general result to which the local evidence led. Wider regional studies have slowly decreased the weight I give to this evidence, until now (though I have never visited the camp again) I believe that the sulphides which I described represent the complete working-over of primary veins.

I have been led to this view largely by my studies at Georgetown, Colorado, in the report* on which (by myself and G. H. Garrey) Mr. Winchell may see how "ingeniously" I have interpreted the conflicting evidence of ascending and descending solutions. In this district some of the veins, containing easily bottomed ore deposits (below which there is little or no cementation of the fault-channels) bear evidence of having been deposited entirely by shallow descending waters; and if I had studied these veins alone, I should have been obliged to simply record the evidence and give the same tentative conclusions as at Monte Cristo. But studies of other veins in the same region reveal the primary ores, extending to considerable depths. In other words, the downward migration of secondary sulphides, keeping pace with erosion, has passed the bottom of some of the primary vein-fillings, while erosion is still working on the middle or even the upper part of other veins.

With these later views of mine, the main mystery of ore-concentration still remained entirely unattacked. Surface influences fit to re-arrange ores already assembled, are well-nigh universal; but ore deposits are not; ores occur in certain definite districts; and though they are mainly noticeably associated with igneous rocks, this is not always the case, nor are they associated with all igneous rocks. The distribution of ore deposits and of igneous rocks shows that the first is associated with, but not strictly dependent upon, the second. It is this main mystery that I believe I have gone far toward solving, in the explanation sketched out in my 'Theory of Ore Deposition.'

I will not go further in this letter in explaining the points raised by Mr. Winchell. In my original article I have limited my statements at the utmost to my personal experience, and I feel insecure in discussing problems with which I am unfamiliar by actual contact, and where the available recorded evidence is conflicting and confusing. My impressions of many of these problems, derived from the writings of authorities, were formerly rather more definite than at present. Until recently, for example, I have had no doubt as to the correctness of the more common explanation that the Mississippi basin lead and zinc deposits had been leached from a disseminated condition in certain sedimentary formations, in which the metals had been deposited from the sea-water; and had been concentrated locally by ordinary ground-waters. Recently I spent a couple of days underground in a great Missouri mine. I should not be justified in making any statements, much less in rushing into print, upon the bases of such brief observation, for then I should be severely and justly criticized by those who have carefully studied the region; but I was astounded in this instance at what seemed good evidence of very intense and very brief ore deposition by ascending waters, this deposition being associated with regional fracturing of the rocks, initiating faulting, and at evidence of the inactivity of ordinary ground-waters in regard to ore-concentration and ore deposition, both before and after the extraordinary event. It is a consequence of this unworthy visit to Missouri that I have privately imbibed some of the proverbial spirit, and henceforth want to be shown.

J. E. Spurr.

New York, May 1.

* About to be issued by the U. S. Geological Survey.

The production of hydraulic cement in the United States during 1907 was, according to advance sheets issued by the U. S. Geological Survey, dated March 25, as follows: 48,785,390 bbl. portland cement, valued at $53,992,551; 2,887,700 bbl. natural cement, valued at $1,467,302; and 557,252 bbl. puzzolan cement, valued at $443,998; or a total of 52,230,342 bbl., valued at $55,903,851. These figures show an increase of 21½% over the production of 1906.

The Rio Tinto Co. produced 1,906,948 tons of pyrites during 1907. Deliveries of sulphur ore were 619,814 tons. The copper produced at the mines was 21,251 tons, and the fine copper in pyrite shipped was 11,066 tons, making a total of 32,317 tons. The net profits during the last four years exceed 6¼ million pounds sterling.

GOLDFIELD, NEVADA.—II.

Written for the MINING AND SCIENTIFIC PRESS
By T. A. RICKARD.

The story of the mines that made Tonopah and Goldfield famous is interesting, but the most picturesque story is that of which George Wingfield is the central figure. When Tonopah was discovered by Jim Butler in 1900, Wingfield was barely 21 years old. Already he had been variously a cowboy, a gambler, a prospector. In the spring of 1901 he went to Tonopah. He came thither from Winnemucca, where he had made a little money and owned some property, but being ambitious for a larger field he left a town that was only a point to punctuate the transcontinental line of the Southern Pacific, and started for the districts that were awakening the desert to busy life. He wandered from Winnemucca to Tonopah, where he went into partnership with Tom Kendall, who owned a saloon. Shortly after he joined Jack Hennessy in starting a roulette table in a room adjacent to Kendall's saloon. This gambling establishment was named the Tonopah Club. It made money fast. In three years Wingfield and Hennessy cleared $300,000. For those unacquainted with local conditions, it may be well to add that it was honest gambling, that is, there was no trickery or device to interfere with the hazard of fortune. The players took the chances of the game, just as they do at Monte Carlo. The Tonopah Club was not as gorgeously furnished as the casino by the shore of the Mediterranean, but George Wingfield ran his place just as squarely as that absurd anachronism, the Prince of Monaco.

As soon as Wingfield began to make $75,000 to $100,000 per annum, he placed the profit from the game in mining stocks and prospects. Tonopah was flushed with newly made wealth. In 1902 and 1903 the lessees on the Mizpah claim made money hand over fist. There was activity in every kind of gambling, from roulette to grubstaking. The chances of the desert were at least as good as those of the table. Wingfield got Nixon interested in some claims called the Boston-Tonopah group, situated at the back of Oddie Mtn. This was the first business deal with Nixon. George S. Nixon was president of the First National Bank of Winnemucca; he is now Senator from Nevada. Many tales have been invented to explain the first association of the two men who later became partners in mining enterprises involving enormous sums of money, but the facts are sufficiently romantic without adornment with the tinsel of fabrication. Wingfield knew Nixon when both of them were living at Winnemucca, and Nixon was known to be a man ready to back any reasonable venture. But the Boston-Tonopah was no good: it was within the mineral belt, but not in the rich ground.

Then came the discovery of Grandpa, or Goldfield, as it was subsequently christened. Wingfield's friend, Tom Kendall, had been partner with Jim Butler in grubstaking Stimler and Marsh, the discoverers of Goldfield. Kendall himself went to see their find, thirty miles from Tonopah. Two days later he stood on Columbia Mtn., which overlooks the present town of Goldfield, and directed Stimler and Marsh to examine and locate the ground to the south, now covered by the Florence and Combination mines. They broke samples from the combs of rock that appeared above the sagebrush and tested them by panning, getting no gold; then they went to the north side of Columbia Mtn. and located the Nevada Boy, May Queen, and a lot of other claims that never amounted to anything. They also located the Booth claim, at the foot of the mountain, for William Booth of the *Bonanza*, a daily paper published at Tonopah. Thus the Combination and Florence ground was not located by the first party of prospectors. This was at the end of 1902. In May 1903 there was organized the syndicate of ten as already stated. Each member of the syndicate was assessed $100, of which $50 was paid up. They sent A. D. Myers and R. C. Hart to Goldfield. Finding some ore, they located the Combination No. 1, 2, and 3 claims, the Hazel Queen, and the Golconda group of six claims, so that ten claims were taken up at this time. Subsequently Myers and Tom Murphy located the Combination Fraction.

Up to this point Wingfield played no part in the exploration of Goldfield, but when the first excitement had passed he bought (for himself and Nixon) some of the shares of the syndicate owning the Combination group, and he also purchased an interest in the first discoveries made by Stimler and Marsh, on the Sandstorm and Kendall. He had become rich, making as much as $200,000 in a single year from the roulette table and successful speculations in local stocks at Tonopah. In the early part of 1904 he bought the various holdings of Con Crooks, who was an old prospector in possession of a number of fractional interests, from a quarter to a half, in over 30 claims, including the Sandstorm, Kendall, and Mohawk, besides groups of claims called the Laguna, Blue Bell, and Conqueror. Crooks had a partner named Harry Ramsey, who now lives in opulent retirement at Berkeley. Wingfield and Nixon bought him out also, not long after they had made their deal with Crooks. Then they purchased Jim Butler's interest in the Sandstorm and Kendall claims. Thus Wingfield and his partner began to have large and scattered holdings in the Goldfield district. At this time Wingfield offered to sell Hennessy a half of all his holdings at Goldfield for $1000, but Hennessy refused it. This is authentic. It is one of the might-have-beens of desert romance. Soon after this unconscious play with fortune, Wingfield began to make money from leases that he financed, providing capital for exploring likely-looking ground. Among these ventures was the Sweeney lease on the Florence lode. In 1905 he made $350,000 from his share in this lease and then he and Nixon, who had remained his partner throughout these transactions, bought a one-third interest in the Florence group of claims. In the autumn of 1906 they obtained control of the Red Top and Jumbo for $1,200,000. It is generally supposed that in this big deal they were financed by others, but I am able to deny such a statement. They had made money enough to swing even a deal involving over a mil-

GOLDFIELD, LOOKING NORTH FROM THE LITTLE FLORENCE SHAFT.

THE TOWN OF GOLDFIELD WITH COLUMBIA MTN. IN BACKGROUND.

The Principal Mines Extend from Columbia Mtn. to the Right, Beyond the Town.

lion dollars. That was the beginning of the consolidation, which was organized on November 13, 1906, under the title of the Goldfield Consolidated Mines Co. The capital is divided into 5,000,000 shares of $10 each, and of these 3,535,171 have been issued. The cost of the properties is placed at $35,085,454. During the past fiscal year the production of ore had a value of $6,296,476. And these were the mines that were hidden under a sagebrush plain diversified by combs of iron-stained rock only five years before. Talk about the creation of wealth! Never was there such a sudden transformation of the waste places of the earth into a hive of human industry.

On April 17, 1906, the day before the earthquake-fire in San Francisco, the big bonanza of the Mohawk mine was cut by the lucky lessees, and during the months when the money markets of the Pacific Coast were closed by the disaster to the City by the Golden Gate, the outpouring of golden ore from the Mohawk, Florence, and Red Top mines redressed the industrial balance and started Goldfield on a career of marvelous prosperity.

In all of these events George Wingfield took a prominent part. He received royalty as owner of claims worked by fortunate lessees and he shared directly in the profits of lessees working on other claims. When only 27 years old he was doubly a millionaire. He proved alert, quick to action, and shrewd in business. When the labor troubles began, in 1906, he showed his fearlessness in facing the agitators. Once when the union tried to boycott the only outspoken daily paper in the district, *The Goldfield Sun*, which is now *The Tribune*, he and Jack Davis took copies of the paper, went into the street, and sold them for the newsboys. The proprietor of a gambling resort is apt to get into shooting scrapes and Wingfield has often had to pull his gun, but he has never taken a human life, his cool courage proving sufficient to carry him through any awkward situation. While he has shown himself reckless, as in the incident above related, he is no fire-eater like Jack Davis, who goes about armed like an arsenal. On one occasion when the miners' strike had reached a dangerous stage, someone took a shot at Jack Davis, who rushed into the local club (the Montezuma), announcing that he had been attacked by the strikers. The electric lights in the club-rooms were turned off instantly and every member pulled his gun and stood at the windows in expectation of an attack. It proved only a false alarm, but when Davis was examined it was found that he wore three overcoats and carried a gun in each of the two pockets, making six revolvers in all. Besides these he carried a bowie knife in his belt and at his back was slung a sawed-off shot-gun. This is the burlesque of the frontiersman. In such fooleries Wingfield took no stock, although ready to assert himself whenever occasion required.

For instance, there was an episode in San Francisco last September. The *Examiner*, one of the Hearst papers, in its customary way, had exploited a story to the discredit of Wingfield. A few days later, Theodore Wores, Edgar Mizner, and J. C. Wilson happened to be at Tait's restaurant. With them was Dent Robert, managing editor of the *Examiner*. One of the party mentioned Wingfield's name and Wilson spoke of him in a kindly way, the result being that a telephone message was sent to Wingfield, who was at the St. Francis, inviting him to join them. Wilson sent his automobile to the St. Francis and Wingfield joined the party at about 11 o'clock. Soon the talk drifted to newspapers, whereupon Wingfield said that he intended to start a daily paper in San Francisco. Robert told him of the difficulties and expense incident to such an undertaking, intimating that it would cost several millions. Wingfield replied that he had the money and, turning to Robert, said: "You seem to know all about the paper business." Thereupon Wores explained that Robert was the managing editor of the *Examiner*. At once Wingfield spoke bitterly of papers in general and of the *Examiner* in particular. Robert called him a liar. Wingfield struck him in the face and pulled a gun. Mizner interfered. Wingfield saw that Robert was unarmed and told him to go out and "get a gun," and he would wait for him while he did do so. Wores explained that the stores were closed at that time of night and no revolver could be purchased until the next day. So the incident closed. Thereafter the *Examiner* was silent as to the doings of Mr. Wingfield.

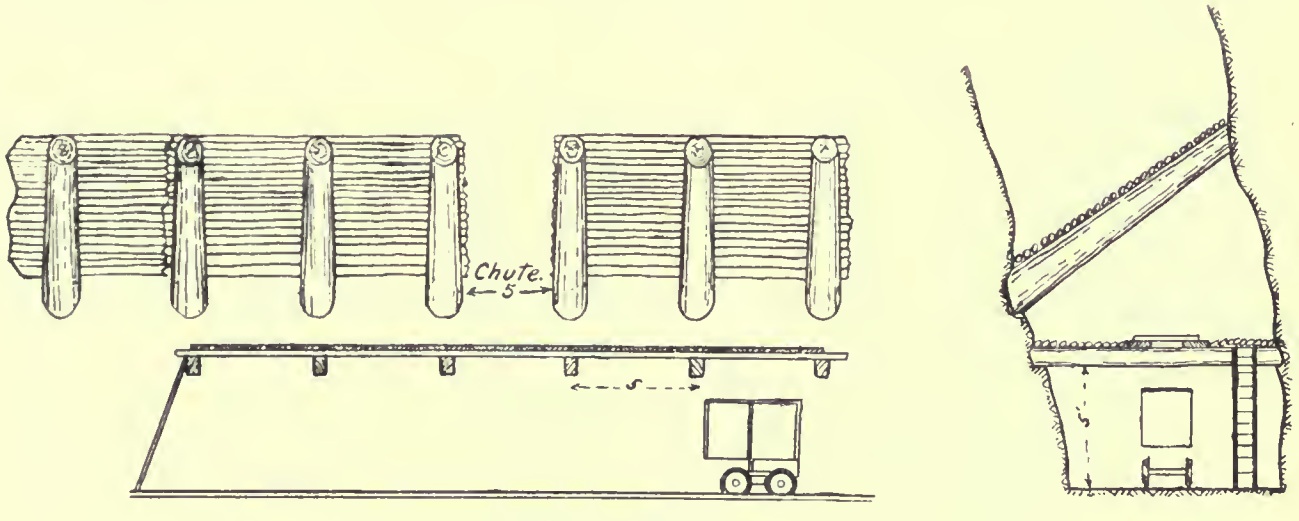
Wingfield is respected by his associates and liked by those who know him. "You cannot bluff him," they say. He is "a man of his word," generous to a fault, and possessed of the mingled recklessness and honesty that mark a few of the best professional gamblers. He is the Jack Hamlin of a later day and had he lived in the golden age of Bret Harte he would have been made as famous as the virile sportsman whose memory is enshrined forever in the story of Poverty Flat.

Another chapter in the romance of the Nevada of today is contributed by the Lockhart and Parker partnership, with which is associated the development of the Tonopah Extension and Florence mines. Alexis Dupont Parker was the treasurer of our University Club at Denver when I lived there, before 1902. He was also chief accountant for the Colorado Southern Railway. Since then he has become an important mine operator, by force of luck and Tom Lockhart. Parker is a graduate of Racine (1879); he was intended for an Episcopal clergyman, but, abandoning that avocation, he decided to learn the business of railroading, from the ground up. So he went to work on the Denver & Rio Grande railroad grade. While thus employed he met T. D. Lockhart, a prospector, who had taken a laborer's job in order to make a little money preparatory to further search for mineral wealth. They became friends. Parker believed in Lockhart and undertook to grubstake him, that is, provide funds for the search after mineral wealth. He got a clerkship in the auditor's office of the D. & R. G.; he prospered; having ability he became an expert accountant and did outside work, as, for example, for the International Trust Co. of Denver. Then he left the D. & R. G. and became assistant to the chief accountant of the Colo-

rado Southern, continuing to advance until he became vice-president and practical head of the Colorado Southern Railway. During all these years he helped Lockhart; even when a clerk on a small salary he managed to save some money to send to Lockhart, who prospected far and wide, but without any noteworthy result. In 1900 Lockhart went to Tonopah and located two claims near the Butler discovery; he was informed that he had overlapped some ground already located (the Sand Grass and Red Plume), so he moved off southward and located the Grand Trunk and C. B. & Q. claims. These were on the sagebrush plain, they showed no sign of ore of any kind, and their validity as quartz claims might easily have been questioned. Meanwhile the development on the Mizpah seemed to indicate the direction of that lode, and he began to sink a shaft through a flow of rhyolite that capped the ore-bearing formation. He started a shaft unaided; he would climb down to the bottom and fill his bucket, then climb to the surface and hoist it with his windlass. Eventually this shaft became the main opening of the Tonopah Extension mine and cut ore at 237 ft. In March 1902 Charles M. Schwab bought the Tonopah Extension for $75,000. For several years previous Parker had ceased to contribute to the expenses of Lockhart's prospecting, and legally the latter was absolved from paying his partner any portion of this stake, but he lived up to the spirit of their arrangement and handed $37,500 to Parker. They call Lockhart mean at Goldfield, and he is thrifty enough in all conscience, but his sense of honor must be far more developed than that of many more generous men. He is the type of the canny Scotchman who is as close-fisted as he is honest. After making money by the sale of the Tonopah Extension, Lockhart went to Goldfield and acquired mining property. He got hold of the Florence, paying $7000 down for a part, with an option for $25,000 on enough more of the mine to give control. Wingfield and Nixon took a lease on the Florence, and the royalty paid by them more than enabled Lockhart to complete his purchase. Soon after making this deal Lockhart overheard one of the owners chuckling over having got the best of him, but he was confident in his opinion of the value of the mine. He told Parker about it, informing him that he need not come into the deal unless he wanted to do so. Parker replied that he would share equally with him in all his ventures. He did well. The Florence has produced $3,000,000 altogether, and of this the royalty to Lockhart and Parker has amounted to fully $375,000, as owners of slightly more than one-half of the stock of the Goldfield-Florence Co. The mine is still young and is destined to add largely to the output of the district.

THE 'CHINAMAN' ORE-CHUTE.

An ore-chute with a peculiar bottom to obviate the difficulties of jamming at the doors and of sudden 'spills' or rushes of ore, which may swamp a car and cause delays until the track can again be cleared, is in use in Western Australia, under the local name of a 'Chinaman.' Its construction is clear from the accompanying cut, giving longitudinal and cross sections. Beneath the bottom of the ore-chute, where it comes to the line of stulls above the gangway or level, is a long platform or deck, supported upon sets of timbers at a convenient height above the track. This platform extends a distance of 10 ft. on either side of the chute. Along the central longitudinal line of the platform are sliding or drop-doors at intervals. The ore spills from the chute and spreads out upon the platform until the angle of rest for the pile is attained, which prevents the possibility of more ore running out. The ore is then drawn through the doors in the platform to the cars below.



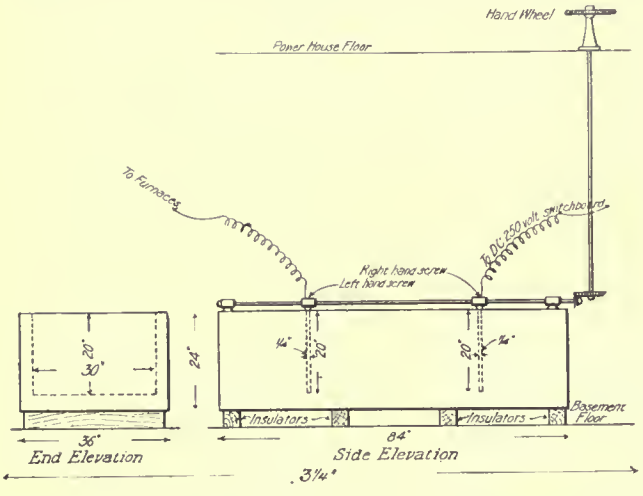
The Chinaman Ore-Chute.

A concrete trestle is a somewhat novel type of structure built across the Salt river, in Illinois, by the Chicago, Burlington & Quincy railway. The structure is 477 ft. long, with six-pile bents spaced 14 ft. apart, and with an average height of 10 ft. The piles are of re-enforced concrete, 22 ft. long, and were driven by a pile-driver with a 3000-lb. hammer falling 24 ft. The piles are all vertical and are capped by deep concrete cross-girders supporting the slabs which form the floor or deck.

Re-enforced concrete lime-kilns in Europe, built without fire-brick or other inside lining, have withstood for several years temperatures from 2200 to 2500° Fahrenheit.

THAWING TAP-HOLES ELECTRICALLY.

A method of thawing out frozen tap-holes of copper blast-furnace fore-hearths or settlers, by means of an electric arc, has proved a great economy at the British Columbia Copper Co.'s works at Greenwood, B. C. Keeping matte tap-holes open in large settlers, particularly where the matte produced carries enough copper to chill readily, is a difficult matter, the matte freezing ahead of the bar as it is driven in where what Mr. Hixon calls 'muscular metallurgy' is employed. Thawing by electricity is not new, but details as to methods of operation, current strength, etc., are not readily accessible. The scheme is as follows: Electrical energy to operate the works is received at 2000 volts alternating current, but for



electric haulage this is transformed by motor-generators to 250 volts direct current. The current for use in thawing should be of low pressure and large quantity, and therefore connection is made from the direct current switchboard into a water rheostat, adjusting the voltage to what may be required by the distance between the plates which receive the incoming and outgoing current, as shown in the accompanying sketch. The adjustment is quickly secured by turning the longitudinal rod, upon which there is a right and a left-hand screw, thereby drawing the plates closer together or moving them farther apart with corresponding variation of resistance. For convenience the tank is placed out of the way in the power-house basement and a mortise-gear operated by a hand wheel from the level of the power-house floor, is employed. At the blast-furnace the wire is attached to a carbon 1 in. diam. by 30 in. long, and this being inserted into the frozen tap-hole creates an arc which quickly melts everything ahead of it, the only trouble being to know when to stop and avoid a 'runaway.' An important point is that the operating workman should wear a mask and very dark goggles, otherwise there will be serious injury to the eyes and the skin of the face. In making connections the positive side only is connected to the carbon stick, the negative being grounded through the settler.

A marco de plata is a weight for silver formerly used in Mexico, equal to 8 Spanish *onzas* or 4608 *granos* (7.3995 oz. troy). The *marco de oro*, applying to gold, contains 4800 *granos*.

Decisions Relating to Mining.

Specially reported for the MINING AND SCIENTIFIC PRESS.

MINING CLAIM—PARTNERSHIP—BREACH OF AGREEMENT—FRAUD.

Under an oral agreement one person was to locate and mark certain mining claims and prepare the notices of location, and the other parties were to have such notices duly recorded at their own expense. This agreement made the parties partners engaged in dealing and in working mining claims. The first party proceeded to locate the mining claims, prepared the necessary notices, and delivered them to the other parties. The parties as such partners proceeded under the agreement and engaged in dealing in and working mining claims. The second parties fraudulently withheld all the notices from recording until after the time for recording the notices had expired; they thereupon, and after the expiration of such time, re-located all such mining claims for their own benefit. In an action by the first party to recover his interest in such claims, the Court held that all such persons became partners for mining purposes from the time of the original agreement, and were all bound thereby; that the action of the second parties in failing to record such notices within the time and perfect such location, and in re-locating the claims, was for the fraudulent purpose of cheating such first party out of his half interest; and that the first party was accordingly entitled to recover his interest in all such claims.

Cascaden *v.* Dunbar, 157 Fed. 62, Oct., '07.

COAL LANDS—ENTRY AND PURCHASE.

There is nothing in the coal land statute intended to prevent either individuals or corporations from acquiring any amount of coal land which it may be possible to pay for or secure. It is only meant that neither an individual nor corporation, either by direct entry in the grantee's own name, or indirectly by procuring an entry by an agent or servant, shall take from the Government more than the limited quantity. An individual having exercised the right to entry may buy of others by ordinary purchase as much more as he pleases; but he cannot acquire another acre from the Government. If he does so, either by direct application in his own name or by employing another to make an entry and then convey to him, he thereby becomes involved in conspiracy, perjury, and fraud. The statute prohibits the right of pre-emption but not of the title to the land, though it may be but equitable.

Pereles *v.* Weil, 157 Fed. 419, Nov., '07.

DAMAGES FOR TRESPASS IN TAKING ORE.

Where a person in the honest belief that he was in the lawful exercise of his right, entered upon the premises of another and removed ore, coal, and other products, he could only be held liable in damages for the actual value of such ore, coal, and other products in their original place. But a person who wilfully and intentionally took ore from the property of another, was held liable to the owner for the full value of the property at the time of such taking, without any deduction for the labor or expenses incurred in removing and marketing the same. Such wrongful taking would not divest the owner of the title, and a third person purchasing such coal or ore with knowledge that it had been so wrongfully taken, was held liable to the owner for its conversion.

United States *v.* Ute Coal & Coke Co., 158 Fed. 20, Dec., '07.

MINING LEASE CANCELLATION.

A mere delay in paying rent or commutation money and failure to begin operation at the time stipulated in a mining lease, was not sufficient ground for the cancellation of such lease before the expiration of the term, where it appeared that the lessee was ready and willing to pay the rent and perform the covenant to open and operate the mine.

Pheasant *v.* Hanna, (W. Va.) 60 Southeast. 618, Feb., 1908.

THE RIGHTS OF THE MINER.

Written for the MINING AND SCIENTIFIC PRESS
By THEO. F. VAN WAGENEN.

To anyone who is attracted by the study of human nature and the phenomena attendant upon the advance of civilization, an examination of the mining laws of the various nations of the world will be most interesting. They are a curious mass of statutes. Until comparatively recent times they appear to have been based on the idea that the miner, by the nature of his occupation, must be a dirty and disagreeable person, and that his business was of such an objectionable kind as necessarily to make him an undesirable member of the community, against whom society needed special protection. Of course, it must be admitted that the miner of the past rarely took a bath. And, passing the most of his waking hours underground in damp, dark, and dangerous places, there was some warrant for differentiating him from the ordinary surface laborer. And as mines had a habit sooner or later of caving in, carrying death and destruction not only to those underground, but to dwellers above them on the surface, his trade naturally acquired a bad reputation.

In addition, mining from the first was recognized as an occupation that interfered seriously with the assumed natural rights of property, as the phrase was originally understood. Real property has always been land—the meadow, the hillside, the enclosed field, the homestead. From time immemorial, when title to such was acquired, either by conquest, or by gift from the conqueror, or by purchase, the possessor was supposed to hold, not only the surface as defined by visible boundaries, but all under it to the mysterious depths, about which little was known. And when people came along who wished to explore those depths, who made holes into which cattle and even human beings occasionally disappeared, who left on the surface unsightly piles of rubbish, and whose activities often resulted in the sinking down of the surface, to the inconvenience or damage of those who had theretofore dwelt securely upon it, society, as represented by both landlords and tenants, became properly scandalized and demanded protection and relief. Probably it was some such train of circumstance that started the idea expressed by the word 'royalty.' The king was appealed to against the miner, and the latter was perhaps given to understand that the former, by reason of his position, was the real owner of all unseen things below the surface, as well as the guardian of the visible world, and that underground material must not be taken away without his permission, and without giving him a certain portion of it as the royal perquisite. Was he not the King, the representative on earth of the Deity? Later, when the supposed divine right of rulers came to be questioned, and mining as a desirable and useful industry was recognized, the right to authorize mining operations passed from the hands of rulers to those of legislature and landed proprietors, excepting as to the precious metals, which naturally fell into the category of 'treasure,' because they could be made into money, the manufacture of coins being held even today as the exclusive prerogative of governments. In due time this idea will also pass, and when it does the word counterfeit and the occupation of the counterfeiter may become not only respectable but laudable. For if he is to be commended who makes two blades of grass grow where before but one flourished, how much more the one who produces two bright dollars where only one had previously existed, provided of course that the new coin be as genuine as its model. But perhaps this is going too fast for the conservative reader.

The miner was at first compelled to pursue his calling under the distinct disapproval of the community. Later he was allowed to operate under a heavy license, and with the condition that a considerable proportion of his output of metal or coal was given to the ruler in return for legal authority to work. Still later the landlord, becoming even a more potent individual than the King or emperor, succeeded to most of these claims, and 'royalty' became 'tribute,' while the right to prospect was retained as a privilege to be granted only by the Government, for the consideration of a license fee. And today, in most parts of the world, except in the western States of America and Alaska, the miner has to pay down hard money for a license before he can even search for valuable outcrops of mineral, and in all of them, with the same exception, he cannot mine and produce the metals without giving up a certain portion of his output either to the governments or the landlords or to both. Such also used to be the situation with the farmer, the hunter, the fisherman, the woodman, and is so still in many old-fashioned and backward communities, and in a few that consider themselves quite modern and up to date; but generally these toilers are nowadays expected to give back only a very small part of the results of their labor, and in an indirect way, so that the old principle of the inherent right of the temporary possessor of a tract of God's green earth to make everyone who labors upon it contribute to his support, and maintain the dignity of his position, has passed into the hands of legislatures, and is so thoroughly recognized as a proper community matter as to be unobjectionable. The farmer no longer protests against taxes, he acknowledges the reasonableness of the theory of riparian rights and stumpage, and he submits gracefully to the dogma of 'eminent domain' when a railroad wishes to lay its tracks across his wheat-fields. But how would he enjoy being compelled to buy a license as a perliminary to locating a new farm on the public domain, or to give to the Government, after he has selected one and brought it into productiveness, from 2 to 10% of his crop annually in perpetuity, in addition to ordinary taxation. Yet the Canadian, Australian, South African, and New Zealand miner is forced today to do both of these things, while in Mexico and all Spanish-American lands, though the right of prospecting and search is free, the principle of a government royalty is maintained, even though the Kings and Majesties have been kicked out, and Presidents and Excellencies substituted. In old Europe, where the battle for human rights has been going on for a thousand years, the landlords still collect heavy

tribute from the miner; the fisherman or hunter is a poacher unless he owns the water or the land where he searches for his food, and the vast majority of farmers pay rent. It will be many a long day before the world as a whole will graduate from the idea that certain of its inhabitants, by the chance of birth or fortune, are entitled to enjoy the assumed luxuries of idleness at the expense of others. The fundamentals of the principles of slavery die hard.

But to return to the miner. Is there anything in his occupation that should warrant the legal disabilities that, until recently and except in our own country, he has borne. We have now the profession of mining engineering, and the majority of these professionals among the civilized nationalities are men of genuine merit and ability, with broad human sympathies, who do not look down upon the actual miner engaged in hitting the head of a drill, who have a genuine love of their occupation, and no sort of repugnance to soiling their clothes or hands. Still further, most of the real miners themselves take a bath at least once a week, and change their clothes with astonishing regularity every Sunday morning. The world is moving, and the time has come when an enquiry as to the rights of the miner is in order, not as a matter of sympathy for his condition, but because it has at last become evident that he is a most necessary and valuable member of the community, and that it will pay us all, in good hard dollars, to see that he gets his dues.

At the present stage of civilization it is abstractly held that the rights of a human individual bear a distinct relation to the benefits he can contribute to the community at large, and are bounded only by the similar rights of others. Thus even a trust may put its hands into the pocket of the commonwealth and abstract a certain portion of its contents, provided it uses the values so obtained in the main for the general welfare. I do not say that this right is legally admitted, but opinion is tending in that direction, and the fact is recognized that individuals who have unusual ability in any line of activity, commercial, artistic, or even cogitative, have more and broader rights than those less favored by nature. What, then, are the rights of the miner? Before this question can be answered the individual himself must be clearly defined and catalogued. I would place him under four heads, as follows: the prospector, the laboring miner, the mining engineer, and the mining investor. This list excludes the promoter and the share speculator, neither of whom may be said to have any rights that are worth mentioning in this discussion. Let us take up each class separately, and consider whether the existing laws of the most advanced nations are such as to afford each the opportunity to do his best for himself and the community at large.

The Prospector.

This individual is at the basis of the mining industry. He is the man who is willing to go out alone or in pairs, with his pack animal and camping outfit, and search the face of nature for evidences of hidden wealth. Let us not confuse him in our minds with the claim locator or 'pegger,' as our English cousins call him, for the latter is merely one who makes a hurried trip to grab vacant ground in the vicinity of a discovery already made or reported to have been made. The true prospector is a pioneer, a man with an instinctive desire to get away and stay away from society, and enjoy solitude and nature. He is always something of a naturalist, like the bug-hunter or the rock-sharp, more or less of a vagabond, and often a shiftless and eccentric party. But he has a consuming curiosity as to nature along his special lines, and a vivid imagination. He is the only kind of a man who will, of his own volition, take the trouble to go over the hillsides carefully and with observation, and, when he finds what he considers to be indications of mineral, stop, and with painful effort that you and I would not put forth, dig and sweat and undergo hardships and privations, in the hope of bringing into actuality the dream of his imagination—a bonanza. His life is generally little better than a succession of disappointments, for out of a hundred prospects where he does a month's or a year's work, rarely more than one responds to his efforts. Nature is prodigal in allurements, but very stingy in grand performance. Of the millions and millions of little threads of mineral that crop out on the hillsides of the globe but an insignificant proportion will ever pay to follow to the depths. The prospector is the one class of individual who will voluntarily take these overwhelming chances. He always believes his vein is going to widen out and become richer in depth, and it is this sublime confidence in luck that leads him on through the disappointments of his life.

Now the prospector requires three things from the community in which he operates, namely, (1) freedom to wander and search and locate mineral ground without being taxed for his activity, (2) laws and regulations covering the acts of location that are simple, inexpensive, and free from technicalities, and (3) a claim of such size and nature that he can easily sell it. For he is never a man of means, his education has usually been sadly neglected, and he is in no sense a miner or workman. These three conditions seem to me to require the absence of any such thing as a prospector's or miner's license, the existence of a location law that is of the simplest kind, with which the most illiterate and careless may comply, and a claim carrying with it the right to follow the ore downward indefinitely, for the latter is the only kind of a claim that he can sell. In support of these views attention is called to the fact that the prospector does not exist in countries whose mining laws do not expressly provide all these conditions. The western part of the United States and Alaska are today almost the only regions of the world where these rights are given him, and within them he flourishes by the thousands. You cannot find him in Texas, where there are hundreds of square miles of unexplored but very promising mineral lands, for the United States mining law does not apply in that benighted region. When the British Columbian law was similar to that of America he poured across the line like an invading army and found everything

there that has been found to date, but when it was altered so that a license was required and underground extra-lateral rights were taken away, he disappeared. His tribe by the thousands are wandering over snow-clad and ice-bound Alaska and finding new districts almost every month, but they stop at the 142nd meridian as if it were a dead-line. There is not a prospector in the whole of the great British Northwest. Down in Arizona and New Mexico they wander over the deserts and through the rugged mountains, finding new mines almost weekly, but not a man can be induced to cross the international boundary into Sonora or Chihuahua. I have spent the most of the last three years traveling through Mexico, from the Rio Grande to the Isthmus of Tehuantepec, and have yet to run across my first prospector.

In Canada, Mexico, Australia, South Africa, and other parts of the world, there are claim locators, denouncers, peggers, and mineral-land appropriators operating under other names, who occasionally by pure accident run upon a new deposit of ore, or who acquire and explore lands in the vicinity of such an accidental find, but as for real prospecting in these lands, there is none in progress. The silver mines of Cobalt, Ontario, were found by railroad graders in the prosecution of their daily task. It was a wandering Boer who noticed and tested the outcrops that have made the Transvaal so famous. The Klondike was discovered by American prospectors who believed they were on American soil. Since the region was determined as Canadian territory, they have mostly departed. The progress of discovery in Australia is so extremely slow, though the country is rich in mineral resources, that the various State governments offer a reward for the location of new districts, and even provide a small government stamp-mill at new camps, to test the ores. Yet there are but few prospectors in the land, and those that do so call themselves are a lazy and worthless lot as a class. But the American prospector has been given a 'square deal,' and in return he has laid broad and deep the foundations of a metal mining industry the like of which has not existed before, nor does exist in any other part of the globe.

The Miner.

The various organizations to which the majority of working miners now belong, represent the efforts of the class to secure for themselves the opportunity to realize a comfortable existence. There is no question of their right to combine for this end. And thinking people who observe the growth of the unions will not condemn the system because it brings some undesirable citizens temporarily to the front of the stage, or because wrong and even crimes may here and there be clearly traced to their membership. All human effort, when operating through organization, will inevitably go wrong to some extent, while yet resulting in a general steady improvement of conditions. Probably the most convincing example of human ability to err when acting in mass is to be found in the history of the Church. Yet we do not blame religion for the hideous crimes and wrongs that have admittedly been committed in her name. The movement to secure better conditions in the life of the laborer is in its infancy, but is rapidly advancing, and its progress cannot be stayed. As far as the miner is concerned, mining laws affect him but little, except as they provide for his safety and for the security of his wages.

The Engineer.

The relations of the mining law to the activities of the mining engineer are of small account. The latter is (or should be) but a specialized business man, and he must take care of himself, either individually or through the numerous engineering societies that exist now in all civilized communities. Perhaps the greatest disability he suffers under is the ease with which the evidence of his technical training may be counterfeited. Anyone in these halcyon days may write or print M. E. or E. M. after his name, without incurring legal penalties or meeting much censure from any source. This is not so much of an injury to the profession as it is to those who purchase professional services. The clients of the doctor and the lawyer encounter the same species of misrepresentation, and it is one difficult to prevent. At any rate, it cannot be prevented through amendments to the mining laws.

The Investor.

This individual, whether belonging to the class of small or large capitalists, depends wholly on the mining law for the quality of his title, and has a right to expect that legislatures will provide such a body of statutes as will give him all protection possible consistent with the general rights of the community. The various mining laws of the world have for their main object the definition of the boundaries of the mining claim. There are but two systems in practice, one of which provides as such boundaries vertical planes extending indefinitely downward, while the other requires that the apex or beginning of the mineral deposit must be within the surface lines of the claim, after which the owner has the right to follow it indefinitely downward on its dip, no matter where it leads him. Thus in one case a grant of a distinct part of the crust of the earth is given, while in the other the grant covers the deposit, together with certain surface rights. Considered wholly by itself, and from the standpoint of the investor, the principle of vertical bounding-planes is entirely right, and the principle of extra-lateral underground privileges is entirely wrong. There is absolutely no case at all for the latter until the general rights of the community come up for consideration. Then the scene changes instantly and completely with all who have arrived at that stage of civilization in which the welfare of the commonwealth is admitted to be paramount to that of the individual. For a community segregated as a State, and in possession of a part of the globe, has the right to insist (against the interests of its individual members) that in the main its lands and waters be put to the best uses that they are capable of. This means that the bulk of the areas suitable for the production of food shall be used for that purpose.

and that no unduly large part of it should be retained as private pleasure reserves: that roads should have the right of way over and through anything, if public advantage is thereby to be gained; that water-ways must not be blocked or made less valuable by riparian rights; that the water of streams capable of producing power or of irrigating waste lands is community property; that forest reservations are in the same category, and finally, that the community may in certain instances be as deeply interested in the development of its underground mineral resources as it possibly can be of any of those that are apparent on the surface, and has the same right to insist that in such cases the interests of the individual must be subservient and secondary to those of the State.

But the underground world is an unseen and unknown one. An inspection of the surface will rarely exhibit the possibilities below. Even where there are strong indications of hidden mineral wealth the best science of the day cannot reveal its extent or give an accurate statement of its value. On this account mining is generally regarded at present as an extra-hazardous occupation, into which only people of a venturesome or specially enterprising nature, or those who have plenty of money to lose, will enter. And, if we except coal and iron mining, there is certainly some warrant for the belief. But before a mine can be developed and worked it must be discovered. There are no instances on record of capitalists, business men, or scientists finding deposits of the metals except by pure accident. This is the work of a special class, namely, the prospectors, and no mining law can result in the uncovering of the hidden wealth of a country that does not provide for this class an adequate reward for their labor. The occupation of the prospector did not exist until the principle of extra-lateral underground rights was invented.

As for the investor, he is a man of more or less means, education, and business training, and is capable, if he exercises the simplest kind of prudence, of protecting himself against the dangers that exist in underground titles under an apex claim. After 35 years' experience under the American, English, and Spanish laws, the writer is deeply impressed with the belief that most of the cases of extensive litigation that have arisen in the past under the provisions of the American law, have resulted from the efforts of unprincipled men to acquire possession of property already proved valuable by others, or from carelessness on the part of investors. There are, it is true, a number of situations occurring under an apex law that can only be settled by the courts, or else by popular action taking the form of tacit understandings arrived at by a community. A well known instance of the latter is the abolition of the principle of extra-lateral rights at Leadville. This conclusion was reached in the face of the written law, and the example has been followed in several other Western districts where the nature of the mineral deposit was complex and hard to fit to the letter of the law. As for the majority of other questions, they have been passed upon by the courts, and a body of decisions and rulings has gradually come into existence so as to cover almost every problem that can arise. The mining investor therefore has but himself to blame if he finds his title, after purchase, a questionable one. Good legal advice should have been sought before the trade was made. To charge his misfortune to the law is not reasonable. Nor is it any more reasonable to seek the repeal of the apex system because of the possibilities of subsequent uncertainty as to title. For the apex and its following rights constitute the reward of the prospector, and it is of the utmost importance, and the greatest general good to the community, to have all the mineral resources of the State discovered as quickly as possible.

The Mining Law.

An impartial examination of the history and statistics of the metal mining industry (excluding perhaps that of iron) will show unmistakably that, considered as a whole, it has never paid, and is not now paying. A considerable number of properties in numerous localities all over the world are yielding dividends to their owners, and may be expected to continue doing so indefinitely. A few exceptionally rich, or large, or advantageously situated districts, are prosperous, and there will doubtless always be such. But when the real internals of the occupation are examined from a cold-blooded business standpoint, the conclusion is forced that the annual crops of gold, silver, tin, copper, lead, zinc, and quicksilver cost, as an entirety, when they arrive on the market, considerably more than they will bring in money or its equivalent. Just what is the excess of expense is impossible to determine. It varies in different countries and districts, and from year to year. The many improvements that are continually being introduced in the methods and tools of the industry appear to have borne little fruit in the matter of reducing the ratio of costs to selling value, which is no doubt due to the fact that all such improvements are immediately followed by the production and treatment of lower grades of ore, on which the possible margin of profit is smaller.

Doubtless at this point the reader will smile and say that my idea is ridiculous. How could an occupation that has advanced and spread with such marvellous rapidity during the last fifty years, have accomplished such progress under such apparently fatal conditions? It does seem unreasonable. We know that the annual output of these metals from the mines of the world was less than $200,000,000 thirty years ago, and that it came from comparatively few localities, while today it is over $1,000,000,000, and almost every nation on the globe turns out some. We also know that the industry pays the wages of a vast army of unskilled and skilled laborers, the salaries of numerous highly trained mining, mechanical, and metallurgical engineers, financial managers, secretaries, accountants, surveyors, assayers, chemists, draughtsmen, etc., and in addition supports a great number of factories producing machinery, explosives, tools, and general mining supplies.

Yet there is much to be said for the position taken. If we consider the nature of mining as an occupa-

tion, and of the metals as articles of commerce, we find that there are some very unusual features connected with both. The inherent peculiarities of the business of underground exploration has been already referred to. As to the metals, they cannot be eaten up like the crops the farmer annually produces. They cannot be burned up as are the products coming from the coal mine, the forest, or the tobacco field. They do not wear out in a year or so, as does the output of silk, wool, cotton, or jute. In fine, they are in a measure unconsumable, except as to such insignificant proportion as is used in certain of the chemical and other allied arts.

The result is that the products from the mines are highly desirable substances for the world in general, even when those engaged in the business of taking them from the ground are doing so at a loss. It is this fact that makes mining communities so prosperous and active, in spite of the actual losses of a majority of the operators. It is the most attractive, alluring, and promising of all industries connected with the production of raw material, because we always hear of the great fortunes made by the few lucky ones, while the story of the innumerable failures is never known outside of their immediate vicinity, or, if known, is promptly forgotten by a thoughtless and optimistic world. Yet it is also the most hazardous. Neither education, intelligence, judgment, industry, capital, nor experience, nor a combination of all of them, will positively insure success.

It is true that some of the articles of commerce that are made out of the metals disappear almost as readily or rapidly as food and fabrics, such as edge tools, paint, etc., yet in the main the metal crop may be considered a cumulative one, of which at least 50%, and probably over 75%, is converted into articles like machinery, buildings, power-transmission lines, etc., which yield a profit annually for years to their owners; or like coin, jewelry, plate, etc., which may always be turned into money without serious, or perhaps any, loss.

Mining laws then should be constructed with regard to the inherent peculiarities of the business of mining, and should not be patterned after statutes devised to provide merely for the safe and simple tenure of ordinary lands. When that is done, and the mines are of good average quality, operations under them will be to the general benefit of the community. A nation possessing a mineral belt within its border has been given a wonderful and important asset, but it must be rightly used. How? Mainly as a lure. No industry, in spite of its individually unprofitable nature, brings population so quickly, and produces so rapidly a raw material that serves as a basis for the inauguration of other branches of commercial activity. With the metals available in quantity, every other industry that is warranted by the climate, the soil, and the environment, springs at once into vigorous life. If, then, a community has mines, its future is assured if they can be brought into operation. What is wanted is their product, regardless, if necessary, of the cost of getting it. It can be secured in one way only, to-wit, by making the conditions of the business such that the industry will attract that class of men who, by temperament, by the exigencies of their environment, or by other circumstances are disposed to take chances, or who instinctively prefer a gamble to any other method of making their way in the world. Of these, there are a large number, and they can always be attracted by the proper kind of laws.

Most of the mining laws in existence have been framed on the theory that metal mining was an intrinsically profitable industry, or that it could be made one in a very short time. If I have shown that this is not the case, and not likely to be for a long time, until perhaps the era of the perfect electrical ore-finder arrives, it will become evident why certain parts of the globe that are known to be rich in metalliferous minerals are but small producers of the same.

A horse can exert, with reasonably good footing, a pull equal to $^1/_{10}$ his weight at a speed of 2½ miles per hour for 10 hours per day for 6 days per week and keep in good condition. On this basis, a 1500-lb. horse would develop 550 foot-pounds per second, which is the conventional horse-power of engineering calculation. The maximum draft of a horse is about half his weight, although horses have been known to exert a pull of two-thirds their weight. Most horses can exert a tractive effort equal to half their weight, at a slow walk for about 100 feet.

The Prospector.

Owing to the large number of specimens forwarded to this department, it has been found necessary in future to make a charge of 25 cents to subscribers for each determination, and $3 to non-subscribers.

The rock sent by J. C. S., of Jerome, Ariz., is serpentine.

The sample sent by H. T. W., of Mendocino county, Cal., is calcite.

A specimen of diorite-gneiss was received from C. A. M., of Nevada county, California.

F. H. C., of East Auburn, Cal., sends: No. 1, chromite; No. 2, chalcopyrite in quartz rock.

E. D. L., of Rawhide, sends: No. 1, gold-bearing quartz in a hornstone, somewhat brecciated; No. 2 is of the same nature.

There is nothing to indicate nickel in the specimens sent by W. S. L., of Silver Peak, Nev. The green color is due to copper.

The samples from Goldfield marked D. F. are: No. 1, quartzite, apparently formed from a rhyolite; No. 2, hornblende-biotite dacite.

The rocks from Rosebud, Nev., marked A. E., are apparently altered and silicious phases of rhyolitic or andesitic rocks. No. 1 and 2, rhyolitic tuff; No. 3, quartzite with pyrite; No. 4 and 5, altered rhyolite; No. 6, hornstone or chert; No. 7, quartzite; No. 8, hornstone.

REFINING AND SHAPING COPPER SIMULTANEOUSLY.

An electrolytic copper process for the simultaneous refining of copper and shaping of the finished product has been introduced by the firm of Sherard Cowper-Coles & Co. in England. The usual current density employed in the new process is 200 amperes per square foot of cathode surface, the voltage at the terminals of the depositing cell being 0.8. To enable finished products to be made direct in one operation from crude copper by electro-deposition, it is necessary to greatly increase the rate at which the copper is deposited, as compared to the rate at which it can be electrically refined, otherwise the process would be too costly for practical purposes. Attempts have been made from time to time to further increase the current density by using mechanical means for keeping the copper smooth during the process of deposition. The Cowper-Coles centrifugal process is distinct from any of these, inasmuch as it consists in revolving the mandrel on which the copper is deposited at a certain critical speed. The result of revolving the mandrel at the comparatively high speed necessary for the proper deposition, using a current density of 200 amperes per square foot, is that every molecule, as it is deposited, is burnished or rubbed down so as to produce a tough fibrous copper. The usual order of things is thus reversed, the present practice being to put mechanical work into a mass of copper instead of treating each molecule as it is deposited. The centrifugal action enables very impure solutions to be used, as the impurities are thrown off by centrifugal force and the rubbing action of the electrolyte, thus preventing the formation of nodules. The makers claim that the copper refined and manufactured into sheets or tubes in one operation is of a hard nature, similar to that which is cold rolled, and that the process is at least ten times faster than any existing electrolytic process; that a high current can be employed; that there is no risk of lamination, as no burnisher is employed; that the plant is simple; and that anodes of very impure copper can be used as compared to the anode copper used in other systems. The process was recently applied to the production of large copper cylinders for printing purposes in the textile industry. The mandrel, or cathode, is driven at the desired speed by means of a belt and pulley. The anodes are cast copper, suspended on a copper ring. The cathode connection is made by means of a mercury cup placed on top of the driving spindle. The copper cylinders are made quite thin, about $^1/_{32}$ in. thick. A roller is caused to traverse the surface of the deposited copper, so as to slightly stretch or expand it. After the roller has passed over the copper once or twice the cylinder can be easily drawn off. It is claimed that copper obtained by this process gives a remarkably high tensile strength.

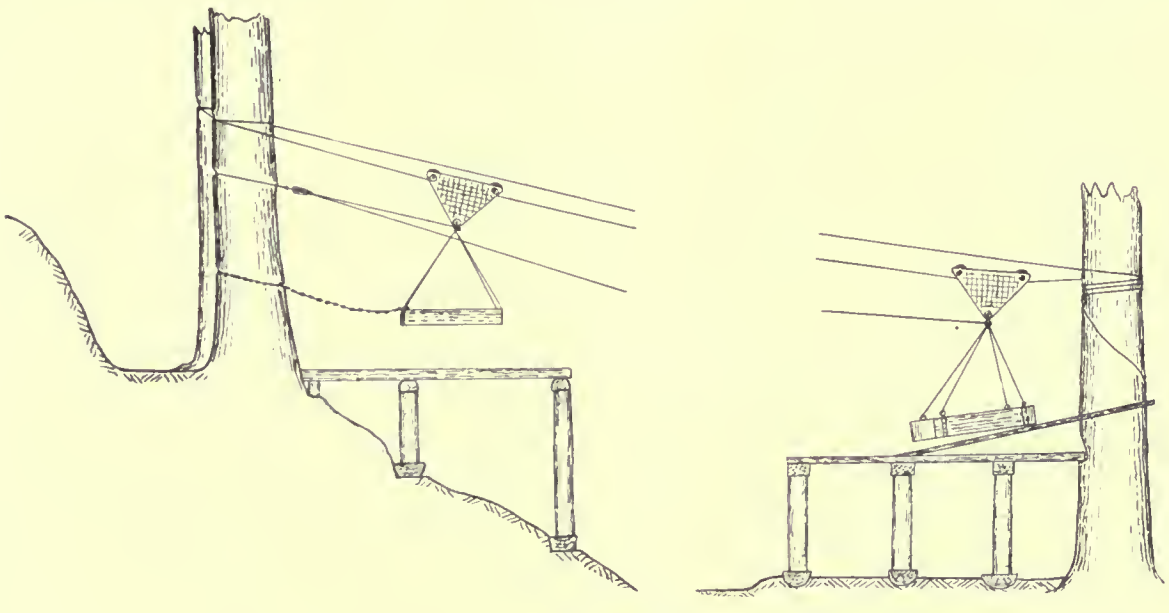
Rift in rocks is an obscure microscopic foliation which in any particular mass, as of granite, diorite, and many other crystalline rocks, will be persistent in one direction, along which the rock will split most readily. The 'grain' of the rock is a still more obscure foliation usually at right angles to the rift, although that will vary with different rocks. The rift and grain may often be easily distinguishable by the eye on clean weathered surfaces, although at times it is quite invisible. Advantage is taken of these lines of weakness in laying out quarries. By blasting by what is known as the Knox system, that is, with black powder and 'expansion tamping,' with the holes set in line with the rift, and bevel-notched at the mouths of the holes in the same direction to aid in starting the break, the rock may be split off in large monoliths with approximately plane-surfaces, and these again may be cut up into smaller blocks by blasting similarly along the 'grain.' In such work the shots must be fired simultaneously by electricity.

The Alaskan coalfield of greatest importance so far discovered, according to the U. S. Geological Survey, is that north of Knik Arm, the most northerly branch of Cook Inlet, including the Matanuska basin. Other mineral wealth is present in the same region, many of the streams containing gold, although it has been discovered only in small quantities up to the present time. The high mountains between Knik and Matanuska rivers are reported to contain copper as well, but the value of the coals of the area overshadows that of the other minerals. Excellent bituminous and semi-bituminous steaming and coking coals, comparing favorably with similar coals from Pennsylvania, occurring in beds ranging in thickness from 2 to 11 ft., underlie at least 70 square miles of the 400 throughout which coal-bearing formations exist. Anthracite coal has also been found in this region, but the quantity is uncertain. Lignitic coals occur in adjacent areas. Accessibility by improved transportation will make these deposits of the highest industrial importance, and railroads now under construction will soon open them up to the world. The U. S. Geological Survey announces the publication of a report on a geological reconnaissance in the Matanuska and Talkeetna basins, made during the summer of 1906 by Sidney Page and Adolph Knopf. The topographic work was in charge of T. G. Gerdine. The geologic report is accompanied by a topographic map on a scale of four miles to the inch, the area represented comprising about 7000 square miles. This map is of particular interest because it covers a part of the route chosen for the inland extension of a railroad which has been planned to connect the Yukon gold district with tidewater. The largest part of the region described in the report is occupied by the Talkeetna mountains, which form an approximately circular mass bounded on the west and north by the wide valley of Susitna river, the most important tributary of Cook Inlet; on the east by the Copper River basin, and on the south by Matanuska valley, from which they rise abruptly. The interior of this mountain mass is an exceedingly rugged area, some of the highest points reaching altitudes of 8000 to 9000 ft., and access to it is possible only along the larger stream systems.

HANDY TRAMWAY.

Written for the MINING AND SCIENTIFIC PRESS
By DONALD F. CAMPBELL.

An engineer often finds it necessary to get a sample of a few tons from an inaccessible prospect for the purpose of making a metallurgical test. The problem often arises whether to pack or sled the ore, and how much should be spent on building a road or a trail. The accompanying notes describe an extemporized aerial tramway employed for bringing down a small tonnage of ore across two creeks and down a precipitous side hill to a wagon road about 600 ft. below. Six tons per hour could be transported by this simple and inexpensive device. The country was well wooded, and a ⅜-in. steel cable was stretched between two big pine trees. At first a large block was attached to a tree at the upper terminal and a ⅜-in. hemp rope taken from the lower terminal and put around the upper terminal and down again. The cable, a ⅜-in. steel guy rope, costing 2c. per ft. was then attached to the end of the hemp rope and unreeled by a horse hauling on the lower end. When this reached the upper terminal the hemp rope was again attached by Crosby clips to the cable farther back and the free end of the cable was then given a twist around the tree to anchor it and again attached to the rope. As it was impossible to get a horse to the upper end, the hemp rope was attached to the cable by Crosby clips at intervals so that it was pulled up on one side and down on the other by the horse, the slack being taken around the trees by hand. When the rope was in position it was tightened at the lower end and twisted around the tree to anchor it. The tightening of the cable was accomplished by attaching a rope to the span with clips, and tying a block and tackle to this. The horse then pulled, and the slack was taken up, and both ends of the rope tightened in this way. The traveling rope used was a ⅜-in. hemp rope and trolleys as shown in the diagram were made in the blacksmith shop. The cost of material for the whole equipment was $30. The erection took a day for three men and a horse, the work being done in winter with snow on the ground, rain falling, and the creek in flood. Some spare rope was left at the lower end, so that the entire ropeway could be moved to get ore from another deposit on an adjoining hill. The upper terminal consisted of a platform from which the boxes could be filled with ore, either sacked or loose, and the lower terminal was provided with a platform and skids so that when the box arrived there was but little jar. The rate of travel could be adjusted by varying the load, and it was found that by sending 400 lb. per trip, the box would just stop at the bottom on the skids without any brake.



A Handy Tramway.

Peat Briquettes.—Word comes from the City of Mexico that an American company has undertaken the manufacture of briquettes from peat. The increasing difficulty of supplying the capital city of the Republic with wood from neighboring forests whence its fuel has come since the days of Cortez, has led to this project of utilizing deposits of peat which have long been known to exist in the vicinity. Eighty years ago Humboldt described magnificent forests within reach of the City of Mexico. Today the region supports only a second growth of little value. The change has been brought about by wood cutters and charcoal burners who have stripped the land and left it to reforest itself if it could, or to relapse into waste. Thus neglected, the land could not grow timber to meet the demands upon it, and the woodcutters have little or nothing near to cut. Fortunately, large bogs of peat are within reach. It has never been much used for fuel because the Mexicans never took pains to learn how to burn it.

Carborundum is made by fusing in the intense heat of the electric arc, a mixture of granulated coke, glass sand, salt, and sawdust. The essential reaction takes place between the silica of the sand and the carbon of the coke when a sufficiently high temperature is reached, and the combination of the excess of carbon, with the reduced silicon to form a carbide of silicon, which latter is carborundum.

DYNAMITE.

Written for the MINING AND SCIENTIFIC PRESS
By CHARLES W. MORSE.

As mining costs receive more business-like treatment more attention is directed to the proper use of explosives, but the explosive itself seems to be the last item to attract careful consideration. The nitroglycerine explosives mostly used in metal mines are ordinary dynamite, ammonia dynamite, gelatine dynamite, and ammonia-gelatine dynamite. The strength of these so-called 'powders' is rated according to the results obtained when fired in the testing mortar, ordinary nitro-glycerine dynamite being used as the standard. This test does not give a true comparison of the relative quickness of the explosives. In the above list the first is the quickest, and the last the slowest. For example, ordinary nitro-glycerine dynamite, because of its quickness, is the most useful for 'mud-capping' or 'sand-blasting' (when boulders are broken by placing the dynamite on them and simply covering it with a layer of mud or moist sand). Ammonia-gelatine dynamite of equal strength, because of its slower action, is practically worthless for this class of work.

Even among engineers one frequently hears the statement that with gunpowder the force of the explosion is upward, while with dynamite it is downward. This is erroneous. Roughly, explosives are chemical compounds or mixtures which, upon explosion or detonation, break up into large volumes of highly heated gases, and it is the expansion of these gases that does the work. By way of illustration, let us consider the gas to be condensed in a metal capsule instead of in the form of potential energy in unstable chemical equilibrium in the explosive mixture. If the capsule should break open suddenly the conditions reached by the explosion of nitroglycerine would be approximated. If the capsule be punctured with many very small holes so that the gas may escape less rapidly, the conditions attending the explosion of black powder or of grades intermediate between black powder and dynamite, would be approximated, according to the speed with which the gas escaped. The more rapid the escape of the gas, the more sudden and violent the shock received by the support on which the capsule was resting. The inertia of the surrounding air is the important factor. Equal volumes of gas expanding an equal amount will do the same amount of work, but in different times in the two cases. Moreover, they will tend to expand with equal force in all directions. To obtain the best result the mine operator will have to determine which of the four explosives is best suited to his work, and what grade of each is best. The mines where special men do all the important blasting are the ones best prepared to carry on such work. The use of a proper detonator is receiving more attention than formerly. With a good ordinary nitro-glycerine dynamite a XXX cap is ample, but a XXXXX cap should be used with all the other grades of high explosives, and even stronger caps are being made for use with gelatine powders.

The fume from the detonation of dynamite is an important matter. The formulas for gelatine dynamite seem to have been given more careful attention than those of the others, and this powder when fresh and sensitive develops but little objectionable gas. The plastic nature of the explosive, and the greater relative safety in handling it, combined with the absence of much objectionable fume, has made this powder popular. I have used common nitroglycerine dynamite which gave as little objectionable fume as the best gelatine-dynamite, and there seems to be no good reason why this powder should not be made as desirable in this regard as the gelatines. The objectionable gases generated by these explosives may be either nitrogen peroxide (NO_2) or carbon monoxide (CO), or both. An excess of NO_2 may be evolved on account of the ingredients being so proportioned that there is an excess of oxygen present, or by the detonation not being perfect. Incomplete or imperfect detonation may happen if the powder has become insensitive, if it is not properly thawed, if it should take fire from the fuse before it detonates, or if too weak a detonator is used. Nitrogen peroxide is poisonous, it makes its presence known by its odor, and by irritation of the eyes and the membranes of the throat and lungs. Carbon monoxide is produced generally when there is a deficiency of oxygen. This gas is odorless. The first evidence of its presence is in the dizziness and staggering produced. When thus warned the individual is often powerless to save himself, though conscious of the danger. This gas is not generated in dangerous quantities by any of the explosives named above, if detonated under proper conditions. The amount of smoke from the fuse is often overlooked in considering the quantity developed by the powder. If fifty feet of fuse should be cut in short lengths and burned in the face of a drift it would make it a disagreeable place in which to remain. After some blasts there is good reason to believe that undecomposed nitro-glycerine remains volatilized in the air, and to this is due in great part the so-called 'powder headache.' When an objectionable powder is used, even though the drift is ventilated thoroughly, there will be enough gas held in the air-space of the broken ore to be disagreeably felt by the shoveler. When the miners are brought out of a mine, overcome by gas, their comrades often throw cold water over them, or strike or kick them 'to make them fight.' As a matter of fact, the system has already received as severe a shock as it can stand. The patient should be kept quiet and warm, and a physician summoned: the face and neck may be bathed with cold water, and a little stimulant administered. 'First aid to the injured' outfits should be kept at all mines and instructions posted so that all may become familiar with them. The average miner is liable to let a man die from inattention, or to kill him by doing the wrong things with the best intentions.

Black sands comprise the minute particles of the heavy, hard, and resistant minerals originally existing in the rocks that form the various gravel deposits of California, as well as of any other country where metamorphic and igneous rocks exist or predominate.

GOLD PLACERS OF SEWARD PENINSULA.

No more striking example of the rapid industrial changes that may be wrought in an isolated province by the exploitation of rich gold placers could be cited than that which is afforded by the history of the large peninsula thrust out from the northwestern coast of Alaska, dividing the Bering sea from the Polar sea. In Bulletin No. 328, soon to be issued by the U. S. Geological Survey, Alfred H. Brooks, in charge of the division of Alaskan mineral resources, says:

"A decade ago Seward Peninsula was little more than a barren waste, unpeopled except for a few hundred Eskimos and a score of white men: now it is the scene of intense commercial activity, supporting a permanent population of 3000 or 4000 people, which in summer is more than doubled. A decade ago the only communication with the civilized world was through the annual visit of the Arctic whaling fleet and the revenue cutter; now a score of ocean liners ply between Nome and Puget sound during the summer months, and even in winter a weekly mail service is maintained by dog teams. Railways connecting some of the inland mining centres with tidewater traverse regions which a few years ago were almost unknown to white men. This industrial improvement is the result of the discovery and exploitation of the gold deposits."

Map of Seward Peninsula.

As there has been but one successful attempt at auriferous lode mining in this region, practically all the gold production — approximately $37,000,000 in the nine years from 1898 to 1907—has been taken from the placers, and it is the geologic and industrial history of these placers which is discussed in this report.

Compared with the output of the California placers, which are estimated to have yielded in two years (1851 to 1853) $62,000,000, and of the Klondike placers, whose output in the first decade is valued at $118,000,000, the production of the Seward Peninsula placer mines is small. A rough outline map in Mr. Brooke's report illustrates approximately the relative size of the gold-bearing areas of the three regions, and his comparison is most interesting.

"The auriferous gravels of California . . . probably cover an area about equal to that occupied by the auriferous gravels of Seward Peninsula, but the Klondike goldfield is probably less than one-tenth as large. The California placers are not only ideally located for economic exploitation, but their gold content averaged no less than that of the Seward Peninsula gravels. Moreover, the high gravels of California are far more extensive.

"The Klondike, on the other hand, is less favorably situated than Seward Peninsula, and its water supply available for mining is much less. It appears, however, that the placers of such creeks as Eldorado and Bonanza in the Klondike, averaged richer than any deposit of similar extent yet found in the peninsula. It was the exploitation of these almost fabulously rich and relatively shallow gravels that brought the Klondike gold output up with a bound, and it is their quick exhaustion that has caused an almost equally rapid decline of the annual yield. There are still extensive bodies of lower-grade gravels to mine in the Klondike, but these can be developed only by means of extensive water conduits or by dredging.

"In the comparison of the Seward Peninsula placer fields with others, it must be borne in mind that probably three-fourths of the entire production has been drawn from the region adjacent to Nome and from Ophir creek and its tributaries. Therefore, though the gold-bearing area is large, yet only a few square miles have been extensively exploited . . . and it is probable that it will be some time before the maximum yield will be attained."

MINE REPORTS.

ESPERANZA MINING CO., EL ORO, MEXICO.

The report of the Esperanza Mining Co. for the year 1907, issued on April 8, shows that this splendid property has produced to date a grand total of ₱44,797,695, from 1,136,300 tons of ore, net dry weight. During the last fiscal year the output was 155,671 metric tons (171,627 short tons), having a gross value of $3,212,666, and producing a net profit over operating expenses of $1,668,457, U. S. currency. The balance-sheets of the company show cash and assets readily realizable after providing for current liabilities of $2,047,607, out of which a final dividend for the year was paid, absorbing $506,256, and leaving a balance on hand of $1,541,357, embraced within which amount it is interesting to note, bullion valued at $393,190. Total dividend-distribution for 1907 reached the handsome sum of $3,037,500. The expenses at El Oro, including development, mining, milling, taxes, superintendence, and selling, amounted to $1,551,398, and renewals cost $30,000.

The report states, "it will be seen that they (the engineers) estimated on December 31, 1907, that there were approximately 65,485 dry metric tons (72,197 short tons) in reserve, technically 'in sight,' which should yield a profit of $225,047. Further than this, there are probabilities of profit from ore not then fully developed, and from ore which exploration is now opening up. It is also conservatively estimated that $250,000 to $300,000 profit will result from the re-treatment of the tailing dumps, after absorbing into operating charges the entire cost of re-treatment plant."

No sinking has been done in the north and south shafts during the year, the vertical depths being respectively 1440 and 990 ft. The workings aggregate 71,051 ft., of which 10,411 ft. was pushed forward within the period covered by the report. Work was concentrated wholly upon the La Esperanza y Anexas, the Sirio and Suceso properties remaining untouched.

The output of the Esperanza mine is divided into sulphide shipping ores, sulphide concentrating ores, and oxide milling ores, which latter are cyanided. The sulphide ores shipped amounted to 6163 metric tons, yielding 2.10 oz. gold and 18.57 oz. silver per short ton, having a gross value of ₱723,456, the net return from the smelter being ₱474,674. This ore by analysis showed the following composition: SiO_2, 89.62%; Fe, 2.75%; CaO, 1.45%; S, 1.83%. The concentrating ores treated reached 72,475 tons, assaying 1.04 oz. gold and 10.40 oz. silver per short ton. The gross value was ₱4,532,028, contained in 1320 dry tons of concentrate, being a concentration of 11.27 into 1. Total lost time in the mill for the entire year was only 18.73 days, a most creditable showing, being approximately 5.13%. Recovery by concentration was 33.24%, being made up of 58.58% of the gold and 30.71% of the silver. The tailing goes to the cyanide mill. This plant treated a total of 66,968 metric tons during the year, assaying 0.46 oz. gold and 7.80 oz. silver per short ton. The gross value was ₱2,181,837, out of which a bullion recovery of ₱1,820,432 was obtained, representing 67.68%, made up of 93.65% of the gold, and 66.13% of the silver. The bullion produced from the concentrator tailing showed a fineness of 55.26 in gold and 649.54 in silver, as against 125.87 and 523.85, respectively, in the bullion produced from cyaniding the oxide ores. Of the latter there were treated 77,036 metric tons, assaying 0.44 oz. gold and 2.61 oz. silver per short ton, representing a gross value of ₱1,837,555, from which a bullion-recovery was made of ₱1,632,641. The percentages of recovery were: gold, 93.82%; silver, 66.09%; total, 70.08%. It therefore appears that the mill as a whole yielded a recovery of 89.29% of the value in the crude ore. In the operation of the cyanide mill only 11.8 days were lost during the year, or 3.23%. The distribution of operating costs shows the following result, stated in terms of metric tons and Mexican currency, costs being figured on the basis of the wet tonnage, which was 163,942 tons: prospecting, ₱0.01; development, ₱1.31; ore-breaking, ₱5.08; hauling to mine bins, ₱1.35; mine to mill bins, ₱0.06; total at mill bins, ₱7.79; sulphide milling, ₱6.68; oxide milling, ₱3.73; mining, ₱8.59; grand total, including other charges, ₱14.33. The net profit per ton was ₱20.01. The average exchange with Mexico for the year was 200.79, so that the above value may be reduced to equivalents in gold by dividing by 2 without introducing an appreciable error.

It is interesting to note the condition on the 'frontier' of the mine, that is, at the faces of advance development-workings. On the San Rafael, level 5, no new orebodies have been encountered, but the known orebodies were found to be more extensive than expected. On level 6 a similar result followed development, and a new drift from cross-cut No. 24 is following a vein on the hanging-wall side of the main lode, which was found on level 7, the assay value, however, being smaller than on the lower level. On level 7 in the south section raise No. 10 was discontinued on account of the diminishing importance of the ore-streak. In the north section a cross-cut to the west has reached the boundary of the property, with unproductive result. The south drift from this cross-cut has followed the hanging-wall vein. The breast is in quartz yielding good assay values across 2 ft. On level 9 the walls are not sharply defined, and the quartz is badly mixed with included slate and porphyry, the assay value being 0.087 oz. gold per ton. The west veins have also shown little encouragement.

ALASKA UNITED GOLD, DOUGLAS ISLAND, ALASKA.

The report for the fiscal year ending December 31, 1907, is an example of complete, well classified data, with costs per ton of ore given in minute detail, figured out to the fourth place of decimals. From the profit and loss account it appears that on the total ore milled for the year, namely 213,370 tons, the operating costs, including administration and fixed charges, were $327,428, or $1.5346 per ton; construction and repairs, $2661.90, being 1.25c. per ton. On the Ready Bullion property, the total costs were $1.54 per ton, and the total yield was $1.69, leaving a net return of 15c. per ton. The average results from the operation of this property since 1898 have been a recovery of $1.89 per ton, against a cost of $1.64, on a total of 1,841,079 tons treated to date, giving an average net profit of 25c. per ton.

Active exploration and development has been going forward amounting to a total of 2372 ft. advance for the year. The ore reserves in the Ready Bullion mine are estimated at 1,378,651, and in the 700-ft. claim at 355,082 tons. The assay values, deduced from 1820 and 526 samples respectively are $2.14 and $2.46 per ton. The gross value of ore crushed in 1907 was $1.8352 per ton, and the loss in tailing was 18.75c. The mill, of 120 stamps, crushed at the rate of 5.75 tons per day per stamp, at a cost of 35.71c. per ton. The recovery from free gold was $1.0505, and from concentrate 63.84c. per ton. The mill was operated 309 days in the year, the loss being therefore approximately 15% of possible time. Further analysis of the milling record shows the following: ounces quicksilver fed to batteries per ton of ore, 0.1301; to plates, 0.0093; to vanners, 0.0040; losses, 0.0346, being a total of 0.1780 oz. per ton. The quicksilver lost was 34.88% of that used. The supplies consumed were 519 shoes, 250 dies, 20 cams, 9 cam shafts, 13 tappets, 5 mortars, and 10 vanner belts. Stems broken and replaced numbered 450. The year's work showed that 1 lb. of chrome steel in the shoes crushed 2.39 tons of ore, and 1 lb. of iron in the dies, which were cast in the Treadwell foundry, crushed 6.09 tons at a total cost for iron and steel of 2.97c. per ton of ore. The distribution of milling costs per ton of ore was: labor, 10.50c.; merchandise, 4.14c.; iron and steel, 3.52c.; foundry, 1.33c.; steam power, 16.4c.; total, 35.89c. At the mine the total costs were 99.94c. per ton, distributed as follows: labor, 52.14c.; merchandise, 6.88c.; iron, 0.09c.; steel, 0.32c.; miscellaneous iron and steel supplies, 1.7c.; foundry, 0.17c.; powder, 15.24c.; steam power, 24.61c.; total, $1.0115, which is reduced by sale of scrap iron to the figure first given.

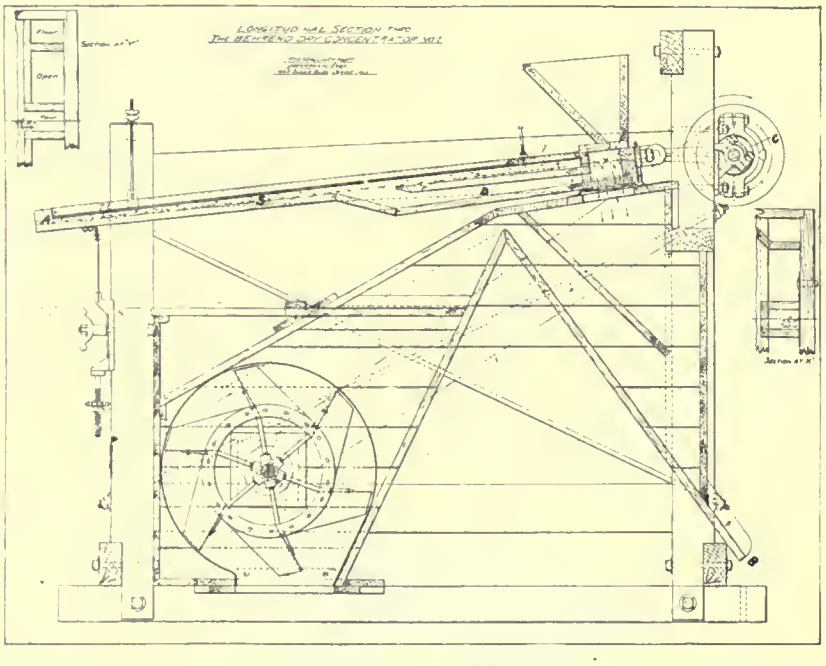
The great increase in the cost of coal, which was $9.12 per ton, as against $5.39 the previous year, has led to the installation of oil-burning equipment, which will materially reduce operating costs in future.

NEW CONCENTRATOR.

The Behrend Dry Concentrator Co. has established offices at 10 Wall St. and at 61 Pearl St., New York. This company has placed on exhibition one of its concentrators. Tests have been run daily on ore received from many parts of this country. The following description of the concentrator will prove of interest.

By referring to the sectional drawing of the machine it will be seen that the air is taken in at A, and is carried over the table S (arrows showing direction), the tailing discharging at B. The table is under rapid vibration by the eccentric C. The dressing-plate covers the table, which in combination with the same constitutes an air-flue; the plate being movable in a perpendicular line so as to be raised or lowered, creating a variable air force or current according to the specific gravity of the materials under treatment and insuring discharge at any degree of concentration desired. The volume of air and ore-feed are under complete control.

The new machine operates on the principle of air-exhaust. the current created by operation of the fan enters the lower end between the table and top movable dressing-plate. Where the concentrate is discharged the air force can be perfectly regulated so as to carry the lighter gangue into the base of the machine onto baffle-boards, and when sufficient weight has accumulated a flexible outlet-valve opens and discharges the tailing. The table being under rapid vibration, beds the heavy material as it moves down in a direction opposed to the air current; the lighter gangue, coming to the surface, is carried off, and the concentrate is discharged as before described. The dust from raw ore undergoing dressing is carried with the exhaust air into ducts and outside of the building into chambers, if desired, or into the open air at a remote point.



JOINT FOR PIPE CONNECTIONS.

The forged steel bolted joint perfected lately by the American Spiral Pipe Works, of Chicago, is claimed to be the most perfect steel pipe-connection or bolted joint ever devised for hydraulic purposes. It is made entirely of steel, and is, therefore, unbreakable. in transport, handling, or use. It consists of two forged steel flanges, with necessary bolts, and a centre sleeve or body recessed at both ends to allow for the insertion of beveled edge rubber, used as packing.

Pipe connections, using this joint, are made in the following manner: Flanges are first slipped over the ends of both pipes to be connected, and the centre sleeve or body is driven over one end of the pipe until it strikes an elevation on the inside of the sleeve. Then the other pipe is taken up and forced into the other end of the sleeve. Beveled strips of rubber, of ample dimensions, cut to the exact length to conform to the circumference of the pipe, are next placed on the pipe and pushed into the recess in the sleeve, or the space between the pipe and the centre body. The flanges are next brought toward the body and bolts put in and drawn up evenly around the pipe. The hubs of the flanges engage the rubber, causing it to expand, making the joint absolutely tight under pressures up to about 250 or 300 pounds.

Besides its many other advantages, this bolted joint will allow slight deflections to be made in the pipe, so as to conform to changes in grade-lines. They are made in sizes from 6 inches up to 34, inclusive.

PUBLICATIONS RECEIVED.

The following re-prints by J. Volney Lewis have been received: 'Geological Survey of New Jersey,' Part III of Annual Report for 1906; 'Bulletin of the Geological Society of America' on the Structure and Correlation of Newark Trap-rocks of New Jersey; and 'Copper Deposits of the New Jersey Triassic,' from Economic Geology.

COMMERCIAL PARAGRAPHS.

THE MOORE FILTER CO. moved their offices May 1 to the Broadway-Maiden Lane Bdg., 170 Broadway, New York City.

THE MEXICAN MINES PROSPECTS DEVELOPMENT CO. has moved its Mexico City offices to the Bancaria Bdg., 5 de Mayo 32.

THE BRETHERTON METALLURGICAL CO. has opened an office at 532 Commercial St., San Francisco, as consulting engineers, assayers, and chemists.

ROBERT W. HUNT & CO. have established an analytical chemical laboratory in connection with their St. Louis office, at 1445 Syndicate Trust Building.

ALLIS-CHALMERS CO.'S district office, formerly in the Atlas Bdg., has been removed to the Phillips Bdg., 599 Mission St., San Francisco. H. D. Scribner is manager.

THE JOHN A. TAYLOR MACHINERY CO. announces the International Machinery & Engineering Co. of Mexico City as agent for its full line of goods in that territory.

THE HUG WATER WHEEL CO., of Denver, Colorado, recently sold one 900-hp. direct connected water-wheel unit to the United Hydro-Electric Co. at Georgetown, Colo.; one 750-hp. direct connected water-wheel to the Continental M. & M. Co., Idaho Springs, Colorado; one 36-in. wheel to Clearwater Gold & Copper M. Co., Iron Mountain, Montana, and one 48-in. wheel to D. M. Reedy, Boulder, Colorado.

BOOKS RECEIVED.

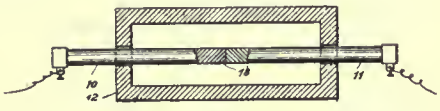
'Earthwork Computations.' By C. W. Crockett. 114 pp. $1.50. John Wiley & Sons. For sale by the MINING AND SCIENTIFIC PRESS. This book gives a number of rules by which the terms necessary for the numerical computations of volumes may be written directly from the notes. One chapter explains the use of the author's slide-rule for the computation of volumes.

'The Electric Furnace.' By Alfred Stansfield. Hill Publishing Co. 211 pp. Price $2. For sale by the MINING AND SCIENTIFIC PRESS. The book gives a full account of the present knowledge of electric smelting practice. The general principles of the subject are clearly stated, and much valuable information can be found in this little volume. The difficulty of securing accurate data, owing to the secrecy maintained in most works, prevents the publication of many definite figures, but the fundamental principles are excellently described.

MINING AND METALLURGICAL PATENTS.

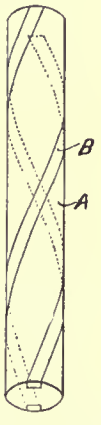
Specially Reported for the MINING AND SCIENTIFIC PRESS.

THERMO-ELECTRIC COUPLE.—No. 885,430. William H. Bristol, New York, New York.



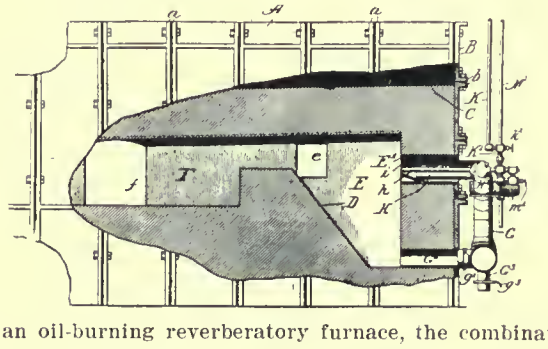
A thermo-electric couple, the two elements which consist of graphite.

STAMP-MILL SHAFTING.—No. 885,259. Frank S. Kirkland, Milwaukee, Wisconsin.



A metallic shaft having an exterior groove therein and a strip of copper electrically welded in such groove, for the purpose specified.

OIL-BURNING REVERBERATORY FURNACE.—No. 886,050. George Fraser, Topeka, Kansas.



In an oil-burning reverberatory furnace, the combination with an initial chamber, of a working chamber, said chambers having a continuous dome, a rearwardly inclined bridge wall intermediate of said chambers, a burner located in the same horizontal plane as the top of the bridge wall and extending in concentric alignment with an opening in the furnace front, said opening being adjacent the under surface of the dome of the initial chamber, an air supply conduit communicating with said burner, an oil supply conduit communicating with said burner, and means for regulating the supply of oil and air to said burner.

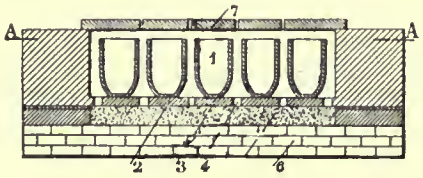
METALLURGICAL TREATMENT OF SULPHUROUS ORES BY THE PRECIPITATION PROCESS.—No. 875,579. Antoine H. Imbert, Grand-Montrouge, France.

The process of reducing metallic sulphides which consists in heating the sulphide in the presence of an oxide and a sulphide of such a character that they will form a dissolvent for the said metallic sulphide with a metal having a greater affinity for sulphur than the metal of the sulphide being reduced.

EXCAVATOR-BUCKET.—No. 885,049. Alpheus E. Holcomb, Chicago, Illinois.

An excavator-bucket having a bottom composed of transverse slats or bars mounted on flexible members supported at their ends, substantially as described.

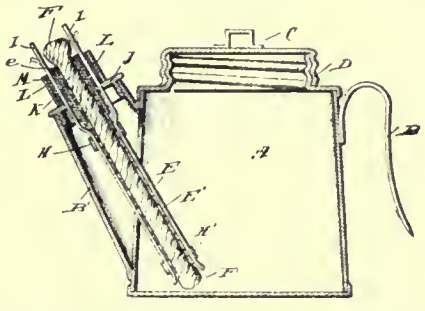
ELECTRIC FURNACE.—No. 885,745. Paul Girod, Ugine, France.



In an electric furnace, the combination, with a receptacle forming a chamber arranged to receive a plurality of objects to be heated, of a mass of resistance material arranged in layers in contact with the sides, ends, and bottom of said receptacle, and a plurality of pole pieces of opposite polarity at each end of the receptacle.

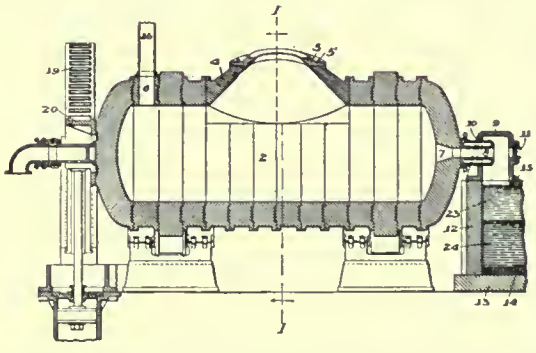
In an electric furnace, the combination, with a receptacle forming a chamber arranged to receive a plurality of objects to be heated, and provided with end extensions, of insulating masonry inclosing said receptacle and arranged to support said extensions, a mass of resistance material between the receptacle and the masonry pole pieces extending through the masonry and arranged to conduct current to the resistance material.

MINER'S LAMP.—No. 886,204. Ralph L. Graves, Sumter, Oregon.



In a miner's lamp, the combination with the spout thereof, of a wick tube container adjustably held in said spout, said container comprising a series of wires held in tubular arrangement, the upper portion of said container being of greater diameter than the lower portion thereof, of a wick collar having a slot in one side and rigidly secured to said spout and projecting beyond the same, within the upper portion of the container, a sleeve surrounding said collar, and provided with slots, and an expansible foraminous wick tube horizontally flanged at its outer end and snugly held in said container and adapted to be longitudinally adjustable in the container by a candlestick pin inserted through the aforesaid slots and to be removed from the outside by means of the aforesaid flange.

SMELTING CONVERTER AND FOREHEARTH.—No. 886,030. Ralph Baggaley, Pittsburg, Pennsylvania.



Apparatus for recovering mineral values from ores which consists in the combination of a smelting converter provided with an ore inlet at one end and with a water-jacketed slag and matte overflow-spout at the other end with a separating vessel and having a covered drop-tube between the overflow-spout and the separating vessel provided with means whereby access may be had to the overflow-spout for examination and rodding when occasion requires substantially as described.

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Editorial.

WE NOTE that our Salt Lake correspondent states that the Ogden smelter "was run for several months last year, proving to be a failure financially but a success metallurgically." This is too much like the surgical operation which was a perfect success, but the patient died. We are glad to believe that the antiseptic treatment of anti-trust enthusiasm will restore the Ogden smelter to a position of usefulness, both metallurgically and financially.

ANNUAL REPORTS of mining companies often contain information of value to mining engineers and mine managers, so we publish a synopsis of one or two such reports in each issue. This week the operations of the North Star mine come under review. No mine has done more to sustain the reputation of California as a mining region; in fact, we may say that the North Star and its neighbor, the Empire, are among the best mines in America. The Empire has been worked without interruption for 55 years and is now 3500 feet deep on an incline of 27°, giving a vertical depth of 1500 feet, while the North Star, which was started in 1850, is 5000 feet deep on an incline of 24°, or 1800 feet vertically. Both mines are producing high-grade gold ore and earning handsome profits, with an outlook for decades of successful operation from orebodies actually explored and proved.

WE NOTE with pleasure that Mr. Arthur L. Walker has been appointed professor of metallurgy in the School of Mines of Columbia University. He will serve as administrative head of the department and take personal direction of the instruction in non-ferrous metallurgy and metallurgical design, thus giving the senior professor, Mr. Henry M. Howe, additional time for research. Mr. Walker is himself a graduate of the Columbia School of Mines of the class of 1883; his first important appointment was as superintendent of the Old Dominion mine at Globe, Arizona; later he changed from mining to metallurgy and was in charge of the Baltimore smelter, whence he was promoted to the management of the Perth Amboy smelter, where he made many valuable improvements in the methods of copper refining. In 1906 he became a member of the executive committee of the American Smelting & Refining Company, and designed the proposed copper smelter for San Bruno, near San Francisco. In March of this year he resigned from the service of the Guggenheims and commenced private practice as a consulting metallurgist. Thus, by training and by experience, Mr. Walker is well fitted to be an efficient teacher. Moreover, by reason of his previous professional success, he is not financially de-

pendent upon his salary as professor. This is the kind of man needed to give life and force to the teaching obtainable at a school of mines, and we congratulate Columbia University on her new professor as much as we congratulate her alumnus on the opportunity to do good service for his alma mater.

IN the London *Mining Journal* of April 25 there appears an article on the world's production of gold by Mr. Waldemar Lindgren. We are informed by him that it is a short-hand report of a paper read at Joplin last November, and as now printed it is full of errors. Apparently it was copied from the records of the American Mining Congress.

THE NEW YORK papers have had a good deal to say in regard to the confession of Mr. William Travers Jerome, the District Attorney, that he was shaking dice with the sons of Thomas F. Ryan at the time Mr. Delphin M. Delmas was summing up for the defence in the Thaw trial. By the way, what memories of belligerent politics, of Pittsburg debauchery, New York predatory finance, and Californian rhetorical confectionery are revived by the names just mentioned; it seems like awakening the gibbering ghosts of a bad dream. To return to Mr. Jerome and his dice: we note that the information was elicited in the course of a hearing on charges of dereliction of duty brought against the celebrated District Attorney by a committee of shareholders in the Metropolitan street railways. We regret that a man who has stood in the front rank of reformers should apparently have been influenced by his social environment and have given cause for doubting the sincerity of his purpose. Jerome has done so much splendid work as an outspoken honest politician that we hope the enquiry will end in his complete vindication. But as to the throwing of dice: this is a pastime not unknown in San Francisco. It is a curious survival of frontier barbarism. Nothing that educated men do is more opposed to what is termed good taste, that is, a cultivated appreciation of what is befitting. A man asks a friend to take a drink, the friend insists that he act as host, they agree to throw dice, and the loser pays; in other words, the successful throw of the dice is accepted as an opportunity for evading the act of courtesy for the privilege of which the two have been striving good-naturedly. A man accepts the arbitrament of chance as a permission to impose upon his friend the payment which he was claiming as an honor a few minutes earlier. It is a silly custom and, apart from the introduction of a gambling device, transgresses the most elementary principle of social courtesy. We are sorry Mr. Jerome was caught in the act.

GEOLOGISTS and miners will enjoy the article by Mr. James F. Kemp, professor of geology in Columbia University, for, whether the waters that form ore deposits be magmatic or meteoric, it is evident that those of which the Professor partakes are sparkling, for how otherwise could the result of his studies be so refreshing? The Professor, who surveys the barysphere from the heights of Morningside, has given us something more stimulating than mere waters, whether those from above the earth or those from under, and he has injected some of the kindly humor that makes the graduates from the Columbia School of Mines look favorably even on paleontology as taught on the banks of the Hudson. We hope that some of our mining geologists will add further to the usefulness of Mr. Kemp's article by contributing to the discussion of the subject, surely one of the most vital to the understanding of the origin and distribution of ore deposits. We shall not offer comment at this time, hoping to hear from our readers first. But we venture to express agreement with the author's humorous reference to the Government geologist who remembered the names of those with whom he disagreed in regard to a scientific question, but forgot the names of those whose ideas agreed with or antedated his own. We confess to being mean enough to chuckle as we read Mr. Kemp's remark, for we have been aware of this little frailty in several writers of Survey publications. In the course of their work they examine mining districts previously investigated, under difficulties, by mining engineers; the pioneer work is apt to be faulty, but it is likely to have ascertained the main features of ore distribution and possibly of rock structure; when the Government geologist (for whose work the engineer as a tax-payer has contributed) arrives on the scene, he utilizes all the available information, and writes a monumental report; in that report he refers to the writings of the non-official geologist only to emphasize points of minor disagreement, making scant, if any, acknowledgement of the help afforded by the same writings. Such things have happened, and the frank mention of them is more likely to prevent friction in the future than to cause trouble in the present.

The Greatest Gold Mine.

OUR LONDON correspondent makes the claim for the Waihi mine, in New Zealand, that it is the greatest gold mine in the world. During the last three years the production has been increased from £733,561 in 1905 to £888,585 in 1907, permitting of an increase in dividends from £346,554 to £442,599, the ore crushed increasing at the same time from 298,531 to 356,974 tons per annum. The yield remains unchanged at 49 shillings per ton, while the cost has been diminished from 21 to 20 shillings. Meantime the ore reserves have been augmented from 938,334 tons at the end of 1905 to 1,299,947 at the end of 1907. Thus there is assurance of a gross production of $4,500,000 per annum and dividends of $2,500,000 for a term of 3½ years. The Robinson mine in the Transvaal is ahead of the Waihi in the amount of its reserves, for it has no less than 4,000,000 tons assured, enough to maintain the present rate of production for 8 years. The production, at the present time, is $6,000,000 per annum, yielding dividends of $3,250,000. In amount of dividends both mines have increased lately, but the Robinson is still ahead. The essential difference between these two great mines lies in the fact that the Robinson has

been explored and developed to its full extent, for in depth the lode passes into a neighboring deep-level property, which incidentally has demonstrated the persistence of the orebody. The Robinson has no apex rights, and is unable to follow its ore beyond the vertical plane of its side-line, while the Waihi has ample room, and can pursue its ore to the maximum depth permitted by human skill. The Robinson has a magnificent but limited future, the Waihi has splendid and, as yet, unlimited possibilities. One is waning, the other is waxing. If the Waihi does not soon exhibit those signs of impoverishment that are inevitable sooner or later in all gold veins, the Robinson will have to take second place, for greatness in a gold mine is measured by two factors, namely, present net yield and assured future productiveness.

Preservation of Natural Resources.

NO ACT of Mr. Roosevelt evinces the intense and real patriotism of his character better than the summons to the Governors of the States to a conference intended to devise ways and means for stopping the waste of natural resources. The conference has proved a notable success. An astute politician, the President can at times display the qualities of the highest statesmanship and he does it in such a forceful sensible manner as to arouse the keen enthusiasm of the American people. Nothing he has done during his double term as President is fraught with such far reaching benefit to the country as this masterful effort to awaken the intelligence and conscience of the nation to the rapid destruction of natural resources. The average man has been inclined to ask: "What has posterity done for me?" And having relieved himself of this Hibernian query, "the heir of all the ages" proceeds to enjoy himself. Thus the intensely unsocial selfish spirit of modern industry has been permitted to despoil a continent in the fierce haste to gather the riches of ore, timber, water, and soil, until suddenly the conscience of the people has been alarmed and the intelligence of thoughtful men has been awakened to a realization of the fact that the inheritance of their children is being devastated. The destruction of timber to make pulp for manufacturing paper is one that impresses us most, for the purpose of it is so largely useless. A yellow journal needs 20 acres of wood to make the paper for one of its Sunday editions! It costs 2080 acres of woodland per annum to print one newspaper! And for what are the forests destroyed, the mountains stripped of their verdure, so as to cause alternate flood and water famine; for what is the land deforested? For a mass of misinformation, for the degrading rubbish of journalism, for vulgar pages of colored print, for all that is opposed to enlightenment and education. It is a hideous waste indeed, for it is the sacrifice of something beautiful and useful to produce something altogether unlovely and vicious. But the timber question is only one of many; there is that of waterpower, coal, iron ore, soil, every one of the basic resources on which our complex civilization is built. They are passing into the hands of the predatory few, for distribution at rising prices to the luxurious many; they are being squandered in the interest of a handful of men, instead of being so conserved, so garnered, and so utilized as to contribute to the well-being of a maximum number, not only of this generation but of those to follow. Never was there a nobler call to real patriotism—not to pride of country nor blatant jingoism, but the willingness to do something in the service of America as a whole, to serve the Americea not of today alone but of the days that are to come. Is this richly endowed continent to become as bare as China, as barren as Assyria; are famine and flood to stalk over the once verdant mountains and the formerly fertile plains of America as over other lands where deforestation has been carried to a finish? Shall the water we drink and the power that runs the machinery of a vast industrial complex pass into the hands of a few exploiters? It is not too late, but it soon will be too late, to take such action as will check the destruction and stop the spoliation. Mr. Roosevelt has done a splendid service.

Philippine Mining Code.

AN association has just been formed in the important Baguio district in the Province of Benguet, Philippine Islands, for the promotion of the mineral industry and a closer co-operation among all the mining districts of the Islands. The association has displayed commendable energy and an appreciation of opportunity in the beginning by appointing a committee which has undertaken the serious task of drafting a mining code, based upon the laws of the United States and Canada, to supersede the defective regulations now in force. The Philippine Commission has accepted the revised code in principle, subject to harmonization with the laws of the United States. We note with interest the adoption of the square mining claim, with rights restricted to side-lines. This is in conformity with world-wide practice, the so-called 'law of the apex,' with its extra-lateral uncertainties, being an American invention. Whatever may be said in its favor as a system to which the United States is committed, the fact remains that when the rights of proprietorship are limited within vertical planes the owner and his neighbor know what pertaineth unto each. That is something at least which appeals favorably to the general mass of mankind, for most men have a leaning toward absolutism, fixedness, recognizable metes and bounds in all three dimensions, however false to the teachings of philosophy conclusiveness may be, and however unproductive of contributory fees to the legal fraternity. To unsettle our mining laws by a change from the extra-lateral right after all these years would be to work disaster to great industries, but to impose our system upon the Philippines when the leading authorities at home are not in agreement over the essential desirability of the law of the apex, while the rest of the world has gotten on well with the old-fashioned tenure that has stood the test of centuries, would seem to be an act of folly. Evidently the people of the Philippines prefer to abide by the evils that they know, than fly to those they know not of.

Personal.

F. W. Bradley is at Tacoma.

Robert Schorr is at Bielitz, Austria.

Harold Braly has returned to Skidoo, Inyo county, California.

W. R. Crosby has gone to Virginia City, Nevada, for a week's stay.

Henry F. Lefevre passed through San Francisco on his way to Mexico.

Frank H. Probert has moved his offices to the Central Bdg., Los Angeles.

G. L. Guthrie has returned from Costa Rica to his home in Atchison, Kansas.

S. J. Kidder of the Desert mill, at Millers, Nevada, was in San Francisco last week.

Chas. E. Uren was in San Francisco last week, on his way to Shawmut, California.

Edgar Newhouse, of the A. S. & R. Co., was here from New York. He has gone to Tacoma.

C. H. Munro is going to Nome to take charge of operations for the Wild Goose Mining Company.

Arthur L. Walker has been appointed professor of nonferrous metallurgy in Columbia University.

W. H. Lanagan leaves for Nome, Alaska, at the end of this month, and will probably remain in Alaska through the winter.

G. H. Clevenger sailed from San Francisco on May 22 for Salvador, to assume charge of a cyanide annex at the Devisadero mine.

J. T. Stevens, superintendent and one of the owners of the Harris mine, at Washoe, Nevada, spent last week in San Francisco.

C. S. Herzig, for the past five years with Bewick, Moreing & Co., has opened an office as consulting engineer at 62 London Wall, London.

E. R. Buckley, formerly State Geologist of Missouri, has resigned to accept the position of mining geologist to the Federal Lead Company.

Arthur S. Eakle, professor of mineralogy in the University of California, has taken a holiday and is now at Washington Grove, in Maryland.

J. E. Spurr and G. H. Garrey, of the firm of Spurr & Cox, are making a geological survey of the property of the Inde Gold Mining Co., in Durango, Mexico.

H. M. Adkinson has resigned as superintendent of the New England Mining Co., at Bingham, Utah, to take a position with A. E. Reynolds in Colorado.

Almon D. Hodges, Jr., editor of the Mining and Scientific Press in 1869 and for three years thereafter, was in San Francisco for a few days on a visit from Boston.

S. F. Shaw, superintendent of the Granadeña Mining Co. at Santa Barbara, Chihuahua, was in San Francisco, and has gone to visit mines in Oregon and Washington.

D. A. Lyon arrived in San Francisco on May 16, from Heroult, Shasta county, California, where he is building an improved electric furnace for the reduction of iron ores.

OBITUARY.

Arthur Koppel, senior officer of The Arthur Koppel Company, died suddenly of heart failure at Berlin on May 13. His death was entirely unexpected, as he was in active charge of his enormous affairs up to the time of death. As an engineer and inventor of economic transportation systems he was well known all over the civilized world. From a very small beginning 35 years ago he had personally built a diversified and progressive industrial establishment, and in the mining fields of Europe, Africa, South America, Mexico, and Australia his enterprise made itself felt, as much in pushing his business as in the kindly interest taken in the welfare of his employees.

Latest Market Reports.

LOCAL METAL PRICES—May 21.

Antimony	12@16c	Quicksilver (flask)	$45@45.50
Casting Copper	14¼@15¼c	Spelter	6½@ 7¼c
Pig Lead	4.60@ 5.55c	Tin	32½@34c

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date	Electrolytic Copper	Lead	Spelter	Silver
May 15	12.63	4.25	4.63	52½
" 16	12.63	4.25	4.60	52⅝
" 17	Sunday.	No market.		
" 18	12.63	4.25	4.59	52⅞
" 19	12.75	4.25	4.59	52⅞
" 20	12.75	4.25	4.59	53⅛
" 21	12.75	4.25	4.59	53½

ANGLO-AMERICAN SHARES.

Cabled from London.

	May 14. £. s. d.	May 21. £. s. d.
Camp Bird	0 12 9 ex div.	0 13 3
El Oro	1 3 9	1 4 6
Esperanza	1 3 9	1 6 3
Dolores	1 5 0	1 5 0
Oroville Dredging	0 11 6	0 11 9
Stratton's Independence	0 1 6	0 1 6
Tomboy	1 10 6	1 11 3

(By courtesy of W. P. Bonbright & Co., 24 Broad St., New York.)

MINING STOCK QUOTATIONS—NEW YORK.

	Closing prices. May 14.	May 21.
Bingham Central	½	½
Boston Copper	12	12⅞
Cumberland Ely	8⅜	8
El Rayo	1⅝	1¾
Giroux Con	3⅜	3⅛
Guanajuato Con	2¼	....
Nevada Con	12¼	11¾
Nipissing	....	6⅞
Tennessee Copper	38	37⅞
United Copper	7½	7⅞
Utah Copper	30¾	32

(By courtesy of Hayden, Stone & Co., 25 Broad St., New York.)

SOUTHERN NEVADA STOCKS.

San Francisco, May 21.

Atlanta	$ 21	Manhattan Con	10
Belmont	1.00	Midway	37
Columbia Mtn	1	Mizpah Extension	10
Combination Fraction	46	Mohawk	.....
Daisy	1.07½	Montana Tonopah	1.60
Fairview Eagle		Nevada Hills	2.25
Florence	3.30	Rawhide Queen	2.00
Gold Bar (Bullfrog)		Sandstorm	25
Goldfield Con	5.45	Silver Pick	16
Gold Kewanas	34	St. Ives	32
Great Bend	27	Tonopah Extension	95
Jim Butler	28	Tonopah of Nevada	7.75
Jumbo Extension	29	Tramp Con	18
Laguna	1.00	West End	39

(By courtesy of W. C. Ralston, 353 Bush St.)

COPPER SHARES — BOSTON.

	Closing prices. May 21.		Closing prices. May 21.
Adventure	2	Michigan	10
Ahmeek	68	Mohawk	53½
Allouez	28	Nevada Con	12
Amalgamated	66⅞	North Butte	65
Arcadian	3¾	Old Dominion	35½
Atlantic	18⅜	Osceola	88
Bingham Con	75	Parrot	21¾
Boston Con	12⅜	Phœnix	50
Butte Coalition	23¼	Quincy	85
Calumet & Arizona	110	Rhode Island	3¼
Calumet & Hecla	675	Santa Fe	2
Centennial	24½	Shannon	13¾
Con. Mercur	40	Superior & Pittsburg	11⅞
Copper Range	72	Tamarack	60
Daly-West	10	Trinity	13¾
Franklin	8¾	United Copper com	7⅜
Granby	91	Utah Copper	32
Greene-Cananea, ctf	9⅝	Victoria	4
Isle Royale	20	Winona	5⅜
Mass		Wolverine	134

L. Vogelstein & Co., New York, give the following figures of German consumption of foreign copper for the period January to March, 1908:

	Tons.
Imports of copper	44,914
Exports of copper	2,084
Consumption of copper	42,830

as compared with consumption during the same period in 1907 of 24,393 tons. Of the above quantity 41,999 tons were imported from the United States.

General Mining News.

ARIZONA.

COCHISE COUNTY.

Fifty feet of ore and altered matter has been cut in a drift which has been driven to the northeast at the 235-ft. level of shaft No. 3 in the Santa Rosa mine, 18 miles south of Douglas. This shaft is now 300 ft. deep.——Joe Bishop has secured a two years' lease on the Bonanza property, in the State of Maine district, and started work. He will sink a new shaft.

GILA COUNTY.

The Old Dominion will probably sink a new shaft at the Continental mine. Two cars of horses and two cars of wagons were recently shipped from this mine to Dalton, Cal., to be used in hauling ore.——The Stonewall mine, 16 miles northeast of Globe, has been re-opened and will be developed by the McMillen Stonewall M. Co. This mine was a great producer twenty-five years ago, and at that time no ore which contained less than 50% of silver was worked. The new company will sink a three-compartment shaft at

Map of Arizona.

a point where the vein is known to be 100 ft. wide.——Development in the Gem shaft of the Globe Con.'s property showed that the Future copper vein is a heavily mineralized orebody 65 ft. wide.——It is reported that development work will begin within 60 days on the holdings of the London Mountain Copper Co. in the Banner district. The Saddle Mountain Copper Co., which owns the adjoining property, is getting ready to operate its 150-ton smelting plant. The grading for a railroad track from Winkelman to the Saddle Mountain camp is completed, and it is claimed that the Southern Pacific will lay track when needed by the mining company.——According to returns to the Assessor, the production of Gila county for 1907 amounted to 35,009,984 lb. copper, 2662 oz. gold, and 91,303 oz. silver. The copper production is an increase of 21% over that of 1906, the gold is an increase of 19%, and the silver a decrease of 5 per cent.

SANTA CRUZ COUNTY.

(Special Correspondence).—The shaft at the Morning Glory mine, in the Harshaw district, is now down 100 ft. and shows a vein of copper 6 ft. wide.——The drifts at the Leek-McDonald mine have been run along the vein at the 200-ft. level for a distance of about 200 ft. and cross-cutting will now be commenced to ascertain the width of the vein at that depth. The ore is a sulphide of copper.——A hoist is being put in place at the shaft of the National Con. M. Co., in the Patagonia mountains. The shaft is down 175 ft. and will be sunk to the 200 when the hoist is in place. Shipping ore is being stoped at the 100-ft. level.——A 650-ft. adit is being driven into the hill to cut the vein at the Four Metals mine, in the Patagonia mountains. It is in 400 ft. and will have a depth of 600 ft. under the capping when completed. A number of new buildings are being erected at the camp.

Patagonia, May 19.

YAVAPAI COUNTY.

(Special Correspondence).—The Juanita Co. expects to install an air-compressor and hoist at its property, 18 miles south of Prescott. Development has been carried on for two years, disclosing both gold quartz and copper-iron sulphides. ——The Poland M. Co., in Big Bug canyon, is milling 50 tons of ore per day and shipping the concentrate to the Needles smelter. One of the features of this mine is the 8000-ft. tunnel that cuts through the mountain ridge from the mill level at Poland to the Lynx creek side at Walker. This tunnel is not only used for transporting ore to the mill, but also for hauling merchandise from the railroad at Poland, to Walker.——The Arizona Power Co. is building a power plant on Fossil creek near its junction with the Rio Verde. The dam is now under construction and it is expected that by the end of this year two generators will be furnishing power to the mines of the county.——G. P. Henderson will put a small pumping plant in the 100-ft. shaft of his property 15 miles south of Kirkland.——The Hale Co. is developing its property 15 miles northeast of Wickenburg, and has installed a gasoline hoist. The shaft is 470 ft. deep, in which ore containing both gold and copper in iron sulphide has been discovered.——The Goddard Co., which owns six claims near Wickenburg, will install a hoist of greater capacity and sink the shaft 200 ft. deeper.—— A small mill for concentrating copper ore has just been completed at the Monarch mine, nine miles from Wickenburg.

Wickenburg, May 18.

CALIFORNIA.

BUTTE COUNTY.

As a result of an accident to the pump at the Stiefer mine, near Oroville, the workings are again flooded. The water was down to within two feet of the point where the motors and other machinery could be rescued when the accident happened. A new pump will be secured and work resumed.

CALAVERAS COUNTY.

Operations will be resumed at once on the Chapman gravel mine on the outskirts of San Andreas. A new shaft will be sunk.——Litigation over the famous Morgan mine, near Angels, has been amicably settled and preparations are being made to open the property, which in the early days yielded millions to its owners. The Irvine heirs received a large sum (the exact amount is not stated) from Mrs. Oelrichs and Mrs. Vanderbilt, for which they in turn have deeded all their interest to the millionaire owners.

NEVADA COUNTY.

(Special Correspondence).—A 16-in. vein of rich ore has been struck in the north drift on the 200 level in the Kenosha. Several specimens of bonanza ore have been taken out. A drift is being driven to cut the Riley shoot. The shaft is going down steadily.—Williams, Ryan and Whiting are preparing to ship a carload of ore from their property to the Selby smelter for a test run.——The fifth raise at the Jenny Lind has cut the channel and exposed large quantities of rich gravel. The aerial tramway has been completed and the mill will start soon. The mine will be in full blast within three weeks.——It is announced that the Sazerac mine will soon be re-opened.——It is reported that the Alta mine will be worked soon.——The adit at the Leduc is in 20 ft., good progress being made. It is expected the lode will be intersected within 250 ft.——Rich ore continues to

come from the drift in the 500 level of the Idaho-Maryland. A winze is going down from the 500 to the 600 level. The drift on the 700 level is being cleaned up. The working force has been augmented.——Good ore is coming from the 400 level of the Central Consolidated. Good quartz has been taken from the croppings, about a mile from the mill.——It is reported that the Brunswick Co. is endeavoring to acquire additional territory for the sinking of a new shaft.——The St. Goddard Co., operating the Delhi mine, has declared a dividend of 5c. per share, a total of $5000. The mine is situated on Columbia hill. It is well equipped and is expected to pay several dividends this year.——R. B. Day, of Alaska, and eastern associates have secured a bond on the Arctic group of mines in the Washington district. The amount involved ranges from $75,000 to $100,000. The bonders will install considerable machinery, including a 20-stamp mill, air-compressor, and hydraulic power-plant. Five veins, running from 2 to 25 ft. wide, traverse the property. Values run from $10 to $1000 per ton in gold.——Development work is going on at the Mountain View.——The Ethel M. Co. is planning to drive a long adit and sink a shaft on its property. Work is under way at several points and good ore is being developed.——A 4-ft. vein of high-grade ore has been struck in the Red Ledge claim, near Washington. A 6-in. streak assaying from $2000 to $30,000 per ton runs through the vein. The find has aroused great interest and several claims have been staked around the scene of the discovery.——Several strikes of importance are reported from the Cherokee section.——The mining industry around Grass Valley is displaying greater activity at the present time than has been manifested for several years.

Grass Valley, May 18.

PLACER COUNTY.

Four men are working at the Valley View mine, cleaning out the old Taylor shaft. A new hoist and head-frame have been put up. The pumps are going night and day, and the re-timbering is being done as fast as the water is lowered. As soon as the shaft, which is 180 ft. deep, has been pumped out, driving and cross-cutting will begin, and a large force of men be put to work. E. Cartwright is superintendent. ——Work will start soon at the Hibbe mine, 12 miles northeast of Lincoln. The mine has been bonded to an eastern company, which, it is reported, will put in new machinery. ——W. S. Fletcher is putting up a 2-stamp mill at his Home Ticket property. He will use electric power.——Lee McCoy is to start a new adit at the lower level on his Vier claim on Georgia hill.——The dredge at the Cash Rock has opened a pit 15 ft. deep, and at this rate the suction pipe should reach bedrock in a short time. The suction pipe is protected by a triangular shield, which serves as a guard to the divers. Boulders as large as 8 in. diam. are drawn through the pipe. The big boulders are raised with grappling hooks attached by the diver, and dumped to the rear of the boat. The sand and smaller boulders are sucked up and dropped upon grizzlies, through which the sand drops into boxes, which are arranged in tiers and move around in nearly a circle so as to give time and space for catching the gold. The boulders pass on over the grizzlies to an endless belt, which carries them to the stern of the boat, where they are dumped into the river. Two divers are employed. They are dressed in regular diving suits and work six hours. Several pieces of heavy river-washed gold have been found in the boxes.

SISKIYOU COUNTY.

Construction has been started on the hull of the dredge which the Scott River Dredging Co. is building on Scott river, near Callahan. The machinery is being hauled from Yreka.——The Oregon placer mine, below Happy Camp, has closed down on account of the suicide of Charles Coster, who was the principal stockholder.——The Nash mine, on Coffee creek, has been leased to R. G. Abrams, who will work it on a large scale.——A new elevator has been put in at the Grider mine, in Seiad valley, and actual mining started. The new elevator has a 16-in. pipe with a 14-in. throat.—— The Klondike mine, on Ash creek, has ordered new machinery to handle 50 tons per day, which will be operated by electric power from the plant of the Siskiyou Power Co. ——Word & Brown have struck the vein in the lower adit of their copper mine on Indian creek.

COLORADO.

CLEAR CREEK COUNTY.

(Special Correspondence).—The Mint group of claims on Kelso Mtn. are again undergoing development. It has been practically assured that an electrically driven plant will be purchased. The Mint adit is now in about 300 ft. and will be continued to the intersection with the cross veins. Within 600 ft. the entire group will be reached, at which point drifts will be driven.——The Smuggler, on Brown Mtn., is the scene of one of the latest strikes. In running the west drift from the fourth level a streak of solid smelting ore has been exposed that measures from 16 to 20 in. wide. The ore assays as high as 220 oz. silver per ton, and 30% lead. Lessees on the third level of this property have been maintaining steady shipments of ore for several months, the average value of the product being $100 per ton in silver and lead.——Since the night shift was put on at the American Sisters mine on Columbian Mtn. the output of smelting ore has been more than doubled. Drifts are being driven on the 275-ft. level, and a streak of ore is followed that is from 18 in. to 2 ft. wide. The drift is now 700 ft. long and the orebody is showing for 300 ft. Stoping is under way, and from recent mill runs average returns of $160 per ton in silver and lead have been received. The mill, of 50 tons capacity, is being run night and day, and shipments are made semi-weekly.——At the Sidney tunnel, Carlson & Co., operating under lease, made a shipment of 50 tons of second-class ore last week that brought a net return of $40 per ton in silver and lead. These men are carrying a stope upon a body of ore that is from 4 in. to 3 ft. wide, a portion of which mills as high as $80 per ton. Killin & Co., leasing to the east, are sending out from 20 to 25 tons of ore monthly that assays 2 oz. gold, 35 oz. silver, and 50% lead. The compressor plant at the tunnel is again in operation and machine drills are in use.——An 18-in. streak of high-grade ore has been encountered in the Pilsen vein, intersected 275 ft. from the entrance of the Pilsen adit. Driving is now in progress, and an average tonnage of ore is being extracted. Assays show 60% lead, 35 oz. silver, and ½ oz. gold per ton. Shipments are to be started in a few days over the Argentine Central.——Wood & Co., leasing on the fourteenth level of the Terrible, are breaking a heavy tonnage of high-grade ore. Mill tests have given a return of $70 per ton in silver and lead. A big body of mill dirt is being followed in the stope, the product being sent to the company mill for concentration.——Work has been resumed on the Raymond adit, after a close-down of four weeks. Driving is in progress upon the Paris vein, cut 800 ft. from the adit entrance, while a streak of $40 silver-lead ore is being followed that is from 4 to 8 in. wide. Stoping will be started soon.——Work has been resumed on the Snowdrift group of claims on Republican Mtn. The Kalamazoo adit is being advanced to intersect the Snowdrift vein, and the objective will be reached within 150 ft. This property has the distinction of having produced the highest-grade silver ore ever mined in the Georgetown district. In 100-ton lots, returns running as high as 15,000 oz. silver were received from marketing the surface product. The deepest workings are down 240 ft., but through the Kalamazoo adit an increased depth of 350 ft. will be secured. ——An electric trolley system will shortly be installed at the Capital adit being driven by the Capital M. & T. Co. Such a heavy tonnage of ore is being broken from the stopes on the Aetna vein that some system must be devised for the transportation of the product. In the east stope the streak has widened from 5 to 13 ft., and the ore is growing richer. In the main body there is 18 to 20 in. of gray copper which assays nearly 300 oz. silver per ton. In the west stope the orebody is from 20 to 22 ft. wide. Eight raises are being made, all of which are up nearly 50 ft. A diamond-drill is to be brought into use at the surface, as a circulation of air must be secured. It will be necessary to sink 1900 ft.——The machinery for the Linn Con. mill is

all in position and the plant will be started as soon as the aerial tramway is ready for the delivery of ore, which should be within 10 days. This plant has a capacity of 50 tons per day, and is built for straight concentration and separation of the lead and zinc ore found in the Mineral Chief mine.——Bowen & Co., leasing on the Sunburst, have started shipments of good-grade ore. Stoping is in progress upon a streak of ore that is 18 in. wide, and the initial shipment milled 170 oz. silver per ton.——M. J. Riley, who is at work on the Grant level of the same mine, has encountered an 8-in. streak of 200-oz. silver ore in the drift recently started to the west. The ground will be in condition in a few days to permit of starting a stope, at which time a heavy tonnage of ore will be mined.——Butts & Co., leasing on the 240-ft. level of the Astor, made another shipment this week that brought a return of 300 oz. silver per ton. ——Lessees at the Santiago, East Argentine, are making ready for a heavy production during the summer months. The bins constructed along the line of the Argentine Central are now being filled, and the capacity of the road will be taxed for several weeks. Harper & Co. are stoping on a 2-ft. body of ore that mills $45 per ton in gold, silver, and copper. Allitude & Co. have a showing equally as good, and two Italians on the fourth level, directly above, have a body of $32 ore that is from 3 to 4 ft. wide.——A big force of men has been put to work in both the Wilcox and Tobin adits, owned by the Waldorf Con. M. Co. Both compressor plants are in operation and a heavy tonnage of ore is being broken.

Georgetown, May 16.

LAKE COUNTY.

The Triumph property, on Breece hill, will be worked at once by L. R. Johnston, who expects to take the ore out through the connection with the Yak adit.——F. L. Loomis has started his contract to advance the face of the Belvidere adit, in the Horseshoe district.

SAN JUAN COUNTY.

The Frank Hough, on Engineer Mtn., will install this spring a new six-drill compressor to facilitate the work on that famous property.——The work of excavation for the Little Nation mill, above Howardsville, is now completed and the floor is laid. A large part of the machinery is already on the ground.——The Stony Pass Co. has resumed work in the Mammoth adit. The face is now in 2200 ft. and will be driven 2000 ft. farther.——The Henrietta property of the San Juan S. & R. Co. will be in active operation soon. The first unit of the mill, the foundations for which were built last fall, will be erected at once.

SUMMIT COUNTY.

The International, at Robinson, has 30 men on its payroll and is shipping 100 tons per day to Leadville and Salida. Since installation of electricity the cost of operating has been reduced, and lower-grade ore is being shipped.——The Ball Mountain Mining Co. has been incorporated to take over and work the old Garibaldi adit, on Ball Mtn., which has been idle for nearly 25 years. Machinery will be installed, the adit re-timbered and driven ahead until the Sunday vein is struck.——Another furnace has been blown in at the A. V. smelter, making a total of six now running.

TELLER COUNTY.

The Mayflower property, near Gillett, will be worked by Horking & Stewart, who will sink the existing 130-ft. shaft still deeper.——McGinn & Conners, who have taken a lease on the Amanda property at Windy Point on Bull hill, are erecting a new hoisting plant on the 200-ft. shaft. They will develop some prospects uncovered by former lessees. ——Three sets of lessees are shipping ore from the dumps of the Moon-Anchor.

IDAHO.

IDAHO COUNTY.

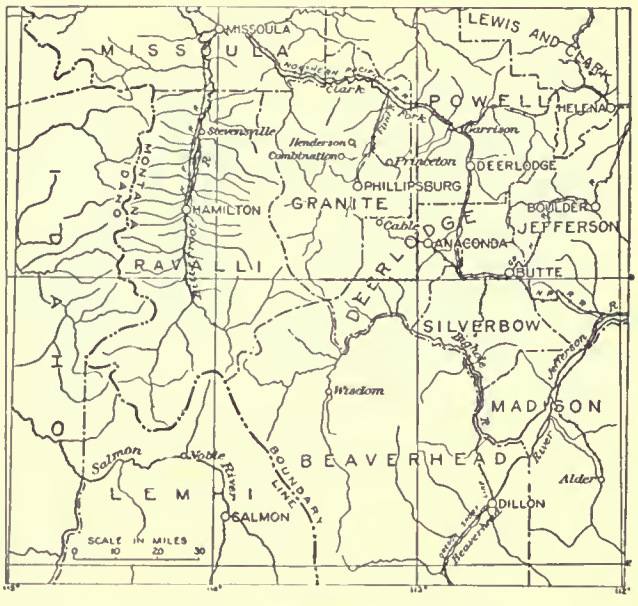
The Elk Gold M. & M. Co. will sink two 100-ft. shafts on their property on the south fork of the Clearwater river. ——The new elevator on the placer property of the Big Sandy Co., near Newsome, was put in operation for the first time last week.——A number of the placer mines surrounding Grangeville are now operating, and more will resume work at once. The snow is melting rapidly and an abundance of water is reported.——The Hogan mine has resumed, with 40 men on its payroll.——The Thunder Mountain Co. has started its new 10-stamp mill.

SHOSHONE COUNTY.

(Special Correspondence).—The Stanley mine, at Burke, is now shipping ore to the New Jersey mill at Kellogg, where 25 tons of ore are being treated daily. About 15 tons per day is being banked to provide against further delays in case the mine closes temporarily.——The National Copper mine near Mullan has struck a vein about 8 ft. wide, carrying copper and silver. Development work is now being pushed in a drift 250 ft. from the foot of a 200-ft. winze.——Four feet of galena, over half of which is shipping grade, has been encountered in a raise from the third to the second level of the Nipsic Mining Co., Ltd., near Burke. The No. 4 adit is to be extended, and it is expected a high-grade body of galena will be encountered. A spur from the O. R. & N. branch line now being run to Murray will probably be built to this district, where several mining properties are already on a shipping basis.

Wallace, May 19.

Galena ore 2 ft. wide has been opened in the Rhode Island property, north of Kellogg. Half of the ore is clean ship-



Montana.

ping grade and the rest of good milling quality. A stringer of good ore 7 in. wide was opened a week ago, and since that time it has widened to 2 ft. The face of the drift is in 275 ft. and has a depth of 125 ft.——Work has been resumed on the property of the Eldorado Co., near Kellogg. The driving of the long cross-cut tunnel is being continued. The adit is now in 275 ft. and it is expected that the main lode on the property will be cut when the adit is driven in 500 ft. ——The Wilbur Mining Co. has awarded a contract for driving 100 ft. of adit, in continuation of the present adit, which was in 200 ft. when work under the present contract was started. The company expects to cut the vein within the next 100 ft., at a depth of 400 ft. The property is situated near the Coeur d'Alene Lead & Silver M. Co.'s property, and lies between the Morning mill and compressor.——Thomas Hololian has begun work on a contract to run 100 ft. of the lower tunnel in the Tam O'Shanter property, which adjoins the Coeur d'Alene Nellie. There are two leads in the claims, and the lower adit has been projected to strike the two orebodies which have been exposed in the upper workings.——The Coeur d'Alene foundry, of Wallace, shipped 8 ore-cars to the Star mine last week.——Development work on an extensive scale is progressing on the property of the Hennessy-Burns Co., near Burke, on the Idaho-Montana line, part of the claims being in each State. The adit now being driven has followed

the vein for a distance of 500 ft. It is estimated that in 150 ft. the miners will strike the second vein.

MONTANA.

The mines of the Butte district produced during April, 21,530,250 lb. copper, which is an increase of 15% over the March production.——The Washoe smelter has contracted to treat 100 tons of ore per day from the Snowstorm mine. ——The Iron Mountain adit, at the Iron Mountain mine, in Missoula county, has been completed, and the unwatering of the mine has begun. The adit, which is 5560 ft. long, strikes the shaft at the 1700-ft. level, below which the water will be pumped.——The Crystal Graphite Co. is preparing for extensive work the coming season at its properties 12 miles east of Dillon, in Beaverhead county.——The Cumberland mine, at Maiden, Fergus county, has been sold to T. L. Lammers and a company of Spokane men, who will operate the mine at once.——The Monitor mine, at Saltese, Missoula county, has been bonded to the Success M. Co. for two years. The bond requires that $60,000 must be spent in development, the shaft must be sunk 300 ft. deeper, and 1500 ft. of underground workings must be driven.

NEVADA.

ESMERALDA COUNTY.

The Pittsburg Silver Peak is to add 50 stamps to its 100-stamp mill at Goldfield.——It is reported that the Bullfrog & Goldfield railroad has passed under the control of F. M. (Borax) Smith and other owners of the Tonopah & Tidewater.——The Rogers-Syndicate lease on the Florence paid the fouth dividend last week, amounting to $30,000. The lease expires July 11.——Another consolidation of Goldfield properties has been effected. The Gold Bar, the C. O. D., and the Victor properties, a total of 90 acres, have been merged under the name of the C. O. D. Consolidated Mines Co., and capitalized at $3,000,000.——The Jumbo shaft of the Goldfield Con. is to be deepened from the 375-ft. level to the 800-ft. mark, at which point it is expected to strike the orebody recently cut in the Mohawk.——The Goldfield mines produced, for the week ending May 16, 1900 tons, valued at $147,500. The Tonopah mines shipped 5570 tons, at an estimated value of $116,200.

LANDER COUNTY.

George Watt has purchased a gasoline hoist for the Spanish Bell shaft, on the property of the Watt Con. Co.——Five tons of high-grade ore were shipped last week from the Jack Pot mine, one mile south of Austin.

LINCOLN COUNTY.

(Special Correspondence).—The Duplex mine, at Searchlight, is being developed and the dump of mill tailing is being cyanided. The mill is to be reconstructed.——A cyanide plant is being built at the Quartette mine, to treat the tailing, a large amount of which has now accumulated. Twenty of the 40 stamps are dropping, and it is claimed a saving of 85% is being made on the amalgamation plates. ——R. J. Stone has leased the Cyrus Noble mill and is doing custom work.——Clayton & Crittenden, who are leasing on the New Year's Gift, shipped 25 tons of ore to the Needles smelter last week. It is claimed that the lowest assay was $78 per ton. The ore is rich in gold, but has enough galena to pay the transportation and treatment charges.

Searchlight, May 16.

LYON COUNTY.

The Gold Center, one-half mile south of Ramsey, has resumed development.——The grading for the Ramsey-Comstock mill is completed and the concrete foundations are being laid.——The Ramsey Con. mine has passed under the control of a syndicate of which Homer Lind of San Francisco is the head.——The Round Mountain No. 1 and three adjoining claims have been sold to H. F. Pierce of San Francisco.

NYE COUNTY.

Thirteen bars of bullion, weighing about 13,000 oz. and estimated to be worth between $50,000 and $60,000, were shipped last week by the Montgomery Shoshone. This represents the clean-up for 29 days of April.——The frame of the Homestake mill is completed and the batteries are set. It is expected that the mill will be running by June 15. ——A strike is reported on the Diamond Queen at Fluorine, which assays as high as $125.——It is reported that C. T. Snedekor has purchased the machinery for a 100-ton custom mill to be built at Manhattan in the near future.

STOREY COUNTY.

Ore from the Chollar and Potosi croppings are to be treated at the Butters plant. The ore will be taken out through the Chollar adit, crushed, and sent to the head of the tramway on a specially constructed track. The lease calls for a daily shipment of 110 tons, but the Butters people expect to treat twice that amount when the work is in full swing.——The Ophir has declared dividend No. 33, payable May 21, the first in several years.

WHITE PINE COUNTY.

The first ore-train from the Veteran mine of the Cumberland Ely dumped its two cars of ore into the bins of the concentrator at McGill last week. The ore was raised through the new four-compartment shaft of the Veteran. Two of the 170-ton locomotives which the Nevada Northern has ordered for the ore-train service have arrived.——The work of clearing the Alpha shaft on the Giroux Con. property is nearly completed and the work of sinking deeper will soon be resumed.——Active work is to be started on the Butcher Boy group of claims. Two shafts are to be sunk near the Ruth mine of the Nevada Con.——Rich ore is reported from the Alvin mine, in the Granite district, north of Ely.

OREGON.

JOSEPHINE COUNTY.

Harrison Bros. have discovered some rich pockets of virgin gold on Williams creek. It is reported that they have cleaned up $30,000 in the last two weeks, and have more in sight.——A 10-stamp mill is to be built at the American Girl and Leroy mines, near Leland.——The Jewett, the principal property in the Mt. Baldy district, will, it is reported, soon be opened.——Work at the Opp mine has been suspended and the 20-stamp mill closed. A cyanide plant is to be installed to treat the tailing.

UTAH.

JUAB COUNTY.

The Eureka Hill shipped 24 cars of ore during April. The shaft is being repaired and will soon be in good shape. ——The Eureka Hill railway received another Shea engine last week.——The Rio Grande railway will run a spur to the lime-rock deposits of the Eureka-Swansea Extension Co. at Robinson. The new smelter at Silver City will use this lime rock.——The following shipments were made last week: Bullion Beck, 3 carloads; Centennial Eureka, 46; Eureka Hill, 10; May Day, 4; Yankee, 4. Total, 67 carloads. ——The Utah Con. has begun sinking a shaft which they expect to be put down 600 to 1000 ft.——The Flying Dutchman people have accepted the terms offered by the Copper Jack for consolidation, and the deal will be finally closed at a special stockholders' meeting to be called at once. The new property will embrace 30 claims, and the three-compartment shaft on the Copper Jack will be sunk 100 ft. deeper.——Work was started last week on the South Swansea with a force of 15 men. The new electric pump has arrived and is being put in.

SUMMIT COUNTY.

The Tantamount Mining Co., recently organized, owns five claims adjoining the Mountain Lake property on the east. They propose to commence development within thirty days.——Preparations are being made for resumption of work at the Silver King Con.——The South Dakota Mining Co. has received a carload of machinery, consisting of a hoisting engine, boiler, and buckets.——The water in the Ontario No. 2 shaft is practically down to the 1500 or drainage level.——The Park City zinc plant is in commission and is said to be successfully treating the ores of the Daly

Judge mine.——A carload of machinery, including a 40-hp. boiler and hoisting engine, arrived last week for the South Dakota property.

WASHINGTON.

OKANOGAN COUNTY.

(Special Correspondence).—The Oroville Con. Co. is sinking an incline shaft on the Sunrise copper claim.——At the Grant mine, drifts are being driven on the first vein struck in the lower adit. Work on the main vein has been stopped because of a large inflow of water.——The Kelsey group, on the west side of Osoogoos lake, is being prospected with a diamond drill.——Gray copper and galena, said to be high-grade, have been struck at a depth of 150 ft. in the Rich Bar mine, near Nighthawk. The orebody is 6 ft. in width and is said to contain a large amount of shipping ore.——Returns from two cars of ore sent from the Dividend and Lakeview mines, near Oroville, show a net profit of $25 to $26 per ton in silver and lead.——A concentrator is to be put up on the Okanogan property this summer, and a cable tram is to be erected to carry the ore across the Similkameen river to the Great Northern railway. The reduction plant, which at present consists of a 10-stamp mill, will be increased by the addition of rolls.——Hydraulic machinery for the Milwaukee Golden Sands Co. is expected soon, and operations will be commenced on that company's group of placer claims up the Similkameen river.

Oroville, May 16.

FERRY COUNTY.

(Special Correspondence).—The B. C. Copper Co. is prospecting the Lone Star and Washington claims, near Danville, with a diamond-drill.——The Faithful-Surprise Mining Co., after driving 600 ft. on the vein of the lower adit-level, will raise 220 ft., to connect with a shaft.——The adit of the Hercules mine, at Park City, is in 410 ft. and has passed through nearly 20 ft. of quartz, which contains considerable pyrite and assays about $10 per ton.——Work has been resumed on the Humboldt mine in the Keller district.——Six men are employed on the Railroad group of claims near Laurier, owned by the Mohawk Company.

Republic, May 12.

STEVENS COUNTY.

(Special Correspondence).—The Easter Sunday Mining Co. has been re-incorporated under the name of the Forrest Mining & Milling Co. The capital stock of the new company is $1,200,000. The Easter Sunday group is in Pierre Lake district.——The No. 3 adit on the Trojan mine is slowly progressing, with three men employed. It will cut the main vein at a depth of about 500 ft.——An adit on the Mohawk mine, near the head of Pierre lake, has been driven 40 ft. on the vein. The vein at the face is six feet wide, all gold and silver-bearing ore, between walls of granite and porphyry.——The North Star Co. is building a superintendent's residence, a bunk-house, and a blacksmith-shop at its property on First Thought hill. A contract has been let for a new adit.——At the Trophy mine the adit is in over 140 ft., leaving 60 ft. more to drive on the present contract. It has passed through slate and phonolite, both formations dipping into the hill. The adit has cut into a contact with porphyry, along which pebbles of iron ore have been found.——A blower has been ordered for the adit at the Globe mine near Orient. Rowland T. Irwin has been appointed manager, and the company is planning to operate on a much larger scale than heretofore.——Eight feet of lead-silver ore has been encountered on the Silver Star property in the Northport district. A crew of 10 men is now being worked there.——A new and rich strike is reported at the Scotia mine.——Three carloads of rich gold-bearing ore was recently shipped to the smelter at Trail, B. C., from the First Thought mine. One of the stopes now shows a 30-ft. face of 10-oz. gold ore. The ore produced last month was of better grade than any ever before shipped from the mine.——Work has been resumed on the 200-ft. level of the Jay Gould mine, in the Chewelah district.——Four 4-horse teams are employed, and 40 to 50 tons of ore, rich in copper, are being shipped daily from the United Copper mine. The company is employing 19 men. The winze from the 400-ft. level is down 50 ft., and a cross-cut from the bottom has developed nine feet of shipping ore. The greater the depth in the mine the better is the ore and the larger the value in both silver and copper.——A new hoist and seven-drill compressor have been purchased by the Chewelah Copper Co. to sink to a depth of 500 ft.——The Blue Star Mining Co. has been organized and has taken over the stock of the old Eagle Mining Co., the holders of which will be protected under the new deal. The Eagle mine is fully equipped with machinery and was at one time a large shipper. Mark Mitchell is the new president and manager.

Spokane, May 12.

CANADA.

BRITISH COLUMBIA.

The Eureka, at Sandon, has re-opened with a pay-roll of 35 men.——The Queen mine and mill, near Salmo, has been sold to Wisconsin capitalists for $175,000. The Queen ore is free-milling. The mill is equipped with a 10-stamp battery, to which 10 stamps more will be added as soon as they can be hauled to the mine from the railway siding, where they now are.——The B. C. Copper Co. is hiring men for its mines and smelter, which opened last week after being shut down since November 12.——The Little Bertha, at Brannock

Centre Star Mine, Rossland, B. C.

City, reports a strike of a 2-ft. vein assaying over $500 in gold and silver.——It is reported that the steam shovel on Pine creek, near Atlin, which is operated by the Guggenheim interests, will start operations soon. The C. A. C. coal mine, at Frank, is to be opened at once. Forty men are now at work repairing the tipple and getting things in shape.——The B. C. Copper Co. has resumed operations at its Mother Lode, Emma, and Oro Denoro mines and at its smelter near Greenwood, employing about 600 men. They expect to pay about the same scale of wages as now in force at the Granby Con.——The Granby ore shipments for April amounted to 87,200 tons.——Following is the tonnage of ore shipped from and crushed at the mines of Rossland for the week ending May 9 and for the year to date:

Mine.	Week.	Year.
Centre Star	3,200	63,678
Le Roi	1,400	31,049
Le Roi No. 2	315	10,344
Blue Bird	20	80
Red Eagle	....	20
Evening Star	....	428
California-Giant	....	60
Totals	4,955	105,659

The receipts of ore at the smelter of the Consolidated Co., at Trail, during the past week totaled 6308 tons. Besides the ore from the Rossland camp, shipments from other mines were received as follows: Snowstorm, 1207 tons; First Thought, 256; North Star, 128; Richmond, 59; Rambler-Cariboo, 23; Vancouver, 20; Reco, 20 tons.

Special Correspondence.

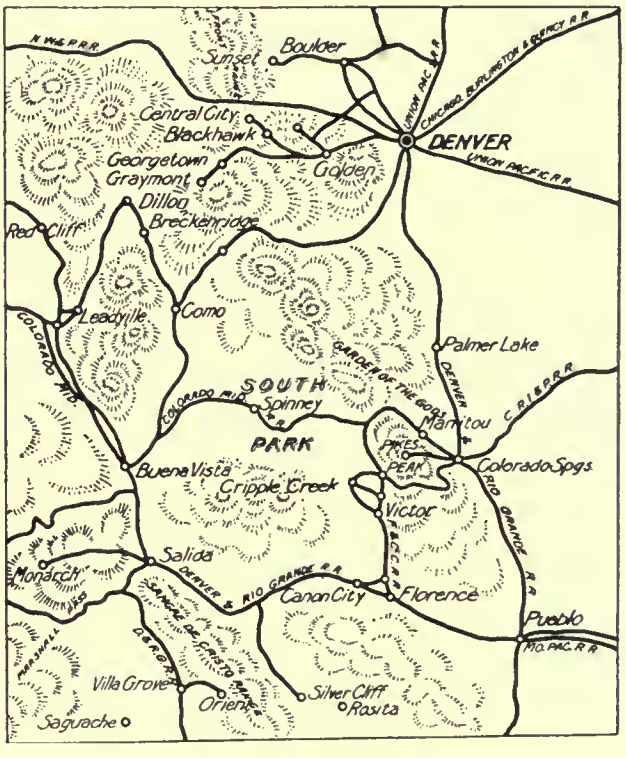
LONDON.

Stratton's Independence. — Methods of Reorganization. — Spanish Coppers.—Waihi Production.

The present position of Stratton's Independence, Ltd., is an apt illustration of the desirability of always keeping plenty of funds in hand during prosperous times to provide for the proverbial rainy day. It is difficult to persuade the ordinary run of shareholders that this is the right policy. Most shareholders seem to consider, after the event, that investment in a mining share is the height of folly and that they must get their money back at all costs. It is often the case that shareholders grudge the laying up of a large balance, or reserve fund, considering the existence of such a balance a sort of dodge of the directors to plunder them. Three years ago the directors of Stratton's Independence were averse to the further distribution of dividends until the prospects of the mine were more exactly ascertained, and they wished to keep intact the balance in hand of something like £100,000. The shareholders publicly and privately created so much ill-feeling on the subject that the directors consented to make a distribution of £75,000, contrary to their own judgment, with the consequence that on June 30 of last year the balance in hand had been reduced to £39,000. This has proved insufficient to develop the resources of the mine on the new system and to install the modern cyanide plant designed by Philip Argall. As you have recorded in your columns already, the new plant is of first-class design and is now in excellent working order. Not only will it treat the old dumps, but it will also separate the friable rich ore by coarse crushing and sizing. The company now finds itself in the extremely awkward position of not being able to meet the whole of the indebtedness incurred in the construction of the mill. A further sum of at least £28,000 is required. Of this, £10,000 was originally provided for the mill, but was spent on the mine; another £2000 is required for mill construction over the original estimate, and £16,000 is required for further expenditure on the mine and for working capital. In addition to this total, it is desirable to have further funds to allow of erecting without delay the second unit of plant for treating the dump-ores. The directors are therefore proposing to ask the shareholders to put up £50,000. The scheme is to issue debentures to this amount carrying 6% interest and entitling the holders to a further 19% as bonus. This really means that the debentures are to receive 25% per annum. These are onerous terms and are much of the same nature as those ruling in the case of the Cerro Muriano, to which I referred in a recent issue. It means that the shareholders must take up their debentures or be left out in the cold, for the interest and bonus on the £50,000 debentures amount to £12,500 per year, which is as much as the new plant is estimated to yield in the way of divisible profit.

This incident leads me to mention that the present state of the law relating to assessment by reconstruction is somewhat uncertain, owing to recent judgments in the High Court. The old way of doing things was to form a new company, issuing shares, partly paid, in exchange for the fully paid up shares in the old company. If shareholders did not take up their new shares they lost all interest in the new company. It was supposed that if the reconstruction scheme was passed by a three-fourths majority, the dissenting shareholders had no further rights, but according to recent decisions it has become difficult to deal with a reconstruction unless voted unanimously. It would not interest your readers if I went into details as to the rights which dissenting shareholders are now supposed to have. It is sufficient for my present purpose to point out this difficulty as the reason for directors adopting different methods of bringing shareholders up to the mark.

During the last few weeks I have referred to several copper mines in Spain that have given dissatisfaction. To those mentioned I must add the San Miguel. This mine is in the Province of Huelva. It was worked for some years by local owners, and in 1904 was acquired by an English company controlled in Germany. For some time this company appeared to be doing well, and dividends were paid regularly. In 1906, however, a bad accident at the mine revealed the fact that there was a good deal of mismanagement, and the board of directors eventually resigned in the autumn of 1907. The new board, under the chairmanship of Nicol Brown, has reorganized the work in many departments and has put things in much better shape. In their investigations the new board found many irregularities in the old way of keeping accounts. For instance, bad debts were not allowed for, and ore in stock was valued at selling price and not at cost. It was thus made to appear that the assets were greater than they really were, leading to the payment of dividends not really earned. In overhauling the balance sheet of December 31, 1906, the new directors found that in a number of items the figures were too high, and have deemed it desirable to write off £15,055. The result is that the dividend of £17,500 distributed on the year's



A Part of Colorado.

working has been unearned, and a deficit of £10,522 made. The case is so bad that legal proceedings against the old directors are contemplated, with a view to recovering from them personally the unearned dividend. The results for 1907 have not been satisfactory, owing to it being necessary to spend money in making good the results of the accident mentioned and in changing the method of treatment. The fall in the price of copper has also adversely affected profits. The present board has found it better policy to increase the leaching operations instead of selling so much of the copper-bearing pyrite. In the long run a better price will be obtained in this way, though for the first year or two the lock-up of copper will decrease the returns. The output of ore in 1907 was 45,462 tons, of which 34,432 was added to the heaps for leaching, and 11,030 prepared for export. The production of precipitate was equal to 367 tons of fine copper, and the deliveries of washed ore were 25,000 tons. When the improved leaching operations are in full working order the output of copper should be about 600 tons a year. Nicol Brown is chairman of the adjoining Peña mine, which is also largely owned in Germany, and under his direction the San Miguel should be pulled round satisfactorily.

I think that it may be taken for granted that at the present time the Waihi in New Zealand is the greatest gold

mine of the world, not so much on account of current production or of its past history, but because of a combination of these two with the outlook for the future. As I said recently, the more development work done, the more stupendous are the ore deposits discovered. During 1907 the tonnage milled was 356,974 short tons dry weight. The recovery was 141,038 oz. fine gold and 773,434 oz. silver. In addition 27,368 oz. gold and 335,318 oz. silver was obtained from the concentrate and 315 oz. gold and 10,541 oz. silver from the slag tailing. The total production was 168,722 oz. gold and 1,119,294 oz. silver, which sold for £878,485. The working costs, development, and office expenses were £357,674. In addition, £53,299 was spent in sinking shafts and in new plant, £35,012 was written off for depreciation of plant, and £31,893 reserved for income tax. The amount distributed as dividend was £396,725, being at the rate of 80% on the issued capital. The mine has been in operation since 1887, but production did not start actively until 1890. In 1892 the yield was valued at £46,219, since when the figures have slowly mounted up to the present level, and the total metals won have sold for £6,290,113. Dividends were first distributed in 1893, and the total to December, 1907, has been £2,693,073. It is impossible to give an exact estimate of the ore reserves, and no attempt is made to do so. It is only necessary to say that the mine really consists of a group of three or more mines, and that at a number of points there is enough ore to feed the mills for years to come.

JOHANNESBURG, TRANSVAAL.

White Labor Experiment.—Gold Law Drafted.—March Gold Output.—High Tube-mill Duty and Low Costs.

The white labor experiment in the mines has proved almost a complete failure. Of the 400 men for whom work was promised, only a few remained longer than a day or two. When they found what terms were offered, most of the unemployed picked up their bundles and started out on the road again. The few that stuck to the work are now earning from 4 to 5s. per day. The men are not entirely to blame for the fiasco. There was bungling somewhere. When the mines offered to take on 400 men, they should have explained the terms and conditions more fully. There should also have been a more helpful spirit shown on the part of the mine managers, and a determination to make the experiment a success. The terms offered the men were in some cases not quite fair. At a few of the mines the unemployed were offered ½d. per inch on hand-drilling, or 1s. 6d. for the usual 36-in. hole. Very few of the men had ever done this work before, but were accustomed to shoveling and tramming, and should have been put to work where they could show the best results. It must be admitted that a large number of the men went to the mines on the off-chance of picking up a highly paid job, and were disappointed when it was not forthcoming. Many of them had no desire to do "Kaffir's work." In other cases some of the unemployed might have succeeded had they received more encouragement from the mine officials. It is to be feared that some managers looked upon the experiment as a nuisance, and were pleased when it failed. All interested in the welfare of South Africa deplore the failure of this experiment. It is imperative to do something to extend the field of employment for white men in this country. It is also necessary to dispel the idea that the white man is an ornament in the industrial life of the country and need only be a supervisor of Kaffirs. He must learn how to work. The champions of the scheme have not despaired yet, but are still trying hard to get work for the unemployed whites. Another attempt will be made to place some of the men in the mines at work where they can earn a fair day's pay for a fair day's work. One mine will try to replace its Kaffir labor with whites in the discharging of sand from the cyanide works.

The native labor returns show that the labor position improved during the month, the net gain being 4015. The number distributed during March was 15,245, against a total wastage of 11,230 due to Kaffirs returning home. Against this gain of 4015 natives must be placed the loss of 1902 Chinese coolies, leaving a balance to the good of 3113 for the month.

The draft of the new gold law has been published, and people feel rather relieved, for although there are some changes, there are none of the socialistic innovations that might have proved disastrous to the country. Before it becomes law, there will be a complete discussion on the new gold law before the next session of Parliament at Pretoria.

The results achieved by the gold mines for March are most satisfactory. The total output from all the Transvaal mines amounts to 574,901 oz., valued at £2,442,042, which is an increase of 32,971 oz. above the February output. The Rand's contribution to the output was 553,440 oz., valued at £2,350,865, while the outside districts contributed 21,461 oz., valued at £91,157. It is the largest production yet recorded as the result of one month's work. The record month of last December, with 583,526 oz., valued at £2,478,659, included some 40,000 oz. of reserve gold turned in by the mines of the Central Administration and Rand Mines group, and yet the March yield is only 8625 oz. behind the swollen return for December. The total number of stamps at work for the month was 8830, of which 8435 were crushing on the Rand.

As usual the Robinson mine heads the list, as regards profits, and working cost per ton crushed, although the

Street in Johannesburg.

Simmer & Jack is first in total production. The profit made by the Robinson was declared to be £80,062, while that of the Simmer & Jack was £63,844. The only company reporting a loss for March was the Lancaster. A new record in working cost was established by the Robinson mine, which reports the cost per ton at 13s. 0.062d. per ton milled. The conditions at this mine are ideal, which explains the improvement in economy. Good though this figure is, there is every reason to believe that it is not the lowest attainable.

The average working cost for the Central Administration, embracing eight of the leading mines, is the lowest on record, namely, 17s. 7.77d., including everything (development, head office expenses, etc.)

Tube-mills helped the output considerably during the month, 70 being at work on the Transvaal mines. The Luipaard's Vlei Estate mine got the high duty of 9.2 tons per 24 hr., while a number of the mines show 8 tons per day and over. The percentage of waste rock sorted varied from nil to 35.63 per cent.

SALT LAKE, UTAH.

Graselli Chemical Co.—Tintic Resumption.—Swansea Consolidated Formed.—Park City.—Mercur Output.

The Graselli Chemical Co. is now operating its zinc-mill at Park City, treating zinc middling from the Daly Judge mill, the Sutton, Steele & Steele process of dry concentration being used. The smelter at Ogden, owned by the Utah Smelting Co., has been leased to a syndicate of Salt Lake and Ogden parties, who will operate it along independent lines. The plant is equipped with one furnace of 250 tons

daily capacity, the ore being reduced to a matte. It is said a second furnace, and possibly a reverberatory, will be installed. Custom ores will be treated, and an effort is being put forth to obtain common-point rates on ores from camps south of Salt Lake City. J. B. Jensen of Salt Lake will be manager. The Ogden smelter was operated for several months last year, proving to be a failure financially, but a success metallurgically.

The ore-purchasing department of the Tintic Smelting Co. will open for business and begin the purchase of lead ores for treatment in the new Tintic smelter, the lead furnaces of which will be ready to go into commission in the early part of June. It is stated by the manager that it will probably be August before the copper furnaces will be ready to receive ores. The lead department will handle 400 tons of ore and fluxes daily. On June 1 the final details will be arranged for a merger of the Swansea and South Swansea mines in Tintic under the name of the Swansea Consolidated Mining Co. These properties have been idle for a number of years; new equipment has been installed and by the time the Tintic smelter is ready for operation the combined property will be in condition to resume production. Ore shipments from the Park City mines last week amounted to 334 tons, the Daly Judge and Silver King Coalition producing 167 tons each. The citizens of Park City, to show their appreciation of the great work accomplished by the management of the Ontario and Daly Mining companies in successfully restoring the Ontario drainage adit, have planned a popular demonstration. They believe the date of the re-opening of the adit marks the beginning of a new epoch in the history of the camp's progress. The April earnings of the Consolidated Mercur Gold Mines Co. has been given out as being $65,000, which is the result obtained from the operation of the mill treating 800 tons of ore per day. The fourth portion of the Boston Consolidated concentrating mill at Garfield, Utah, is practically ready for operation, and will probably be placed in service June 1. The Little Beaver Mining & Milling Co., operating in Beaver county, has leased the 20-stamp mill of the Estella Gold Mining Co. near Milford and placed it in commission.

Another blast furnace is to be installed at the Yampa smelter within the next fortnight. The Yampa is now handling 800 tons of ore per day, and it is expected that this figure will be increased to 1000 by July 1, when the new converter will be ready for use. After that the blister copper will be made at the plant, instead of shipping the matte.

BISBEE, ARIZONA.

Copper Queen Con.—Complete Change in Method of Handling Ore.—Central Power Plant.

At the Queen property for a considerable period extensive improvement and construction has been going on, both underground and on the surface. The greater part of this work is in preparation for a complete change in the system of handling the ore, together with the installation of an economical and thorough electric equipment over the entire property. The ore is at present hoisted through five shafts. The power for the property is likewise produced at a number of individual plants widely scattered. In the near future the ore will be hoisted through one centrally located shaft, the Sacramento; and the power for the property will be generated at one main power plant. With this end in view, the Sacramento shaft has been sunk to a depth of 1200 ft., and will within a few weeks be connected with all the other underground workings by drifts, in which traffic will be concentrated. These drifts will serve every level from the 400 down. At the same time a thoroughly equipped modern power plant has been under construction, and is now practically complete. Up to the present the ore has been transported to the different shafts by man or mule-power; the individual cars run onto either two or three-deck cages, hoisted to the surface, and from there pushed by hand varying distances, and dumped into the railroad cars to be taken to the smelter at Douglas.

With the new system installed, the old shafts will be used only for handling men, timbers, and waste. The ore will be drawn by motors to the new Sacramento shaft through the haulage drifts, which will be used exclusively for long-distance haulage. For the present there will be about five and one-half miles of these drifts in use. The motors are made by the Goodman Co., weigh two tons each, and are expected to handle about 10 tons of ore per trip, running at the rate of 6 miles per hour. At the shaft the ore will be dumped into 50-ton ore-pockets, and hoisted through two compartments in skips with a capacity of 60 cu. ft. each. From the skips it will be dumped into hoppers, and from these, by means of a belt conveyor, carried directly to the railroad cars.

At the Sacramento a first-motion Nordberg hoist will be used, with round rope and cylindrical drums. The drums are 7 ft. diam., with 5 ft. face, and are connected to the main shaft by friction clutches operated by hydraulic pressure. Post brakes are used, also controlled by hydraulic pressure. The hoisting engine is a double, compound, tandem, condensing-engine made by the Nordberg Co. The erection of the hoist is well under way. At present the five main hoists, and an equal number of dinkey hoists, are run by steam power generated at the individual shafts. There is a saw-mill at each one of these shafts, with its own small engine, using steam for power. Thus far, air for use underground has been compressed at the old power-plant near the Czar shaft, and at the Lowell shaft. Electric power for general use over the whole property has been generated at the Czar power-plant and at the Spray shaft. The pumps underground are run either by steam or by electric power, most of the water being handled by steam pumps. The small hoists underground use either air or electric power. To do away with these unnecessary plants and to simplify, enlarge, and cheapen all power production, the new power plant has been built. The purpose of this plant is threefold: first, to produce steam for operating the machinery in the plant proper, the Gardner hoist, and the Sacramento hoist; second, to compress air for the machine-drills underground over the entire property, and for power to run the Holbrook, Spray, and Lowell hoists; third, to generate electricity for the underground haulage system, the Czar hoist, electric lighting of mines and buildings, and for operating all the smaller machinery connected with the mines, including saw-mills, machine-shop, small timber-hoists underground, blowers for ventilation, etc. This new power plant contains four 400-hp. Stirling water-tube boilers, equipped with Foster superheaters and Greene fuel economizers. The working pressure is 150 lb. Oil is used for fuel. There are two 25-hp. plunger feed-pumps, electrically driven. The two air-compressors are of the cross-compound type, each rated at 3500 cu. ft. free air displacement per minute. The high and low-pressure steam-cylinders, made by the Cooper Co., are respectively 19 and 40 in. diam. The stroke is 48 in. The air-cylinders, which are of the Ingersoll-Rand make, are 21½ and 35½ in. diam., respectively. The working pressure of the air is 100 lb. per sq. in. Later a third compressor will be added, which is now in the old power-house at the Czar. This is an Ingersoll-Rand with a capacity of 1700 cu. ft. per min. There are three 500-kw. Curtis vertical steam turbines, generating an alternating current of 2200 volts. A portion of this current will be converted at the power-house to direct current at 250 volts, by two rotary converters. This part of the electric power will be used mainly for underground haulage. The rest of the power will be distributed by alternating-current lines at high voltage and transformed at various points, as its use requires. Two of these turbines will be kept constantly in operation supplying 1000 kw. Both compressors and turbines are equipped with barometric condensers. The circulating water for the condensers is pumped by the Connersville rotary pumps, of which there are three driven by 60-hp. variable-speed direct-current motors, regulated by a float in the hot-well. This water is pumped from the hot-well to a cooling-tower, from which it flows by gravity to the condensers. It is expected by the management that early in July the entire new system of handling the ore will be in operation, and all the production of power will be centralized in the one main power-plant.

JEROME, ARIZONA.

Drainage and Ventilating Adit.—Rapid Driving.—Working Fire-Stopes.—Additions to Smelting Plant.

The new drainage and ventilating adit of the United Verde mine, at Jerome, Arizona, will be 6600 ft. long, and will connect with the mine at the base of the new 1000-ft. shaft. It has been driven 3800 ft. from the portal, on the mountain slope that overlooks the Verde river; and 800 ft. from the shaft. The adit will have a uniform grade of 0.5%, the cross-section being 7½ ft. high by 8½ ft. wide. The lower section of the work is in the limestone country and the upper end has passed through quartz-porphyry, which is the mineral-bearing rock of the district. The heading from the shaft-end is now close to the contact of the quartz-porphyry with the lime; the work here is also cutting through a water-course. In driving this adit, on the lower section, two shifts of machine-men with Ingersoll drills, with two chuck-men to a shift, followed by three shifts of shovelers with three men per shift, have averaged 9.1 ft. per day for the year. They have driven as much as 87.5 ft. in one week. All the rock is transported to the portal in cars hauled by mules. The drills are run by an electrically driven air-compressor. At a point 1800 ft. from the mouth of the adit is a raise which taps a creek-bed above, the water from which drives a Pelton wheel, generating sufficient power to operate a Sturtevant fan, which discharges the gases into the raise above and draws pure air to the breast of the adit from the portal, through a 22-in. pipe. By this method it is stated that the smoke from 15

United Verde Smelter at Jerome, Arizona.

charges of explosive is cleared from the workings in 20 minutes. The drill-holes average 6 ft. deep. The driving on the shaft-end of this adit has been attended by more difficulties in ventilation by reason of the high temperature of the air in the workings above. Ventilation is accomplished here by electric fans, conveying air through a pipe 11 in. diam. In driving this end of the adit timbering and board-lagging has to be maintained up to the heading, the timbers being set 2 ft. apart, centre to centre. All the mine drainage, and the water from which copper in solution is to be precipitated, will be passed to the 1000-ft. level, thence out through this adit, there being a box channel in the bottom for the purpose. At the mouth of the adit this copper-bearing water passes into a precipitating flume 5 ft. wide and 10 in. deep, having 0.8% grade. The flume will be half a mile long, with settling-boxes 120 ft. apart. The precipitation will be accomplished with scrap-iron. The mine-workings are everywhere timbered with square sets, filled closely with waste. The 'fire-stopes,' that is, those in which the sulphur in the ores is burning, are being successfully worked at the 300-ft. level by air being blown to the face, driving the gases back into the old workings. Without these strong currents of fresh air, forced in by electrically operated fans, the atmosphere in the fire-stopes would rise to 180 or 220°. The fire in those stopes which are not being worked is confined by cement bulkheads with steel gates. The ores are on fire in various places from the fifth level to the surface.

In the smelting plant two 550-ton furnaces are operating all the time, and a third furnace of equal capacity a part of the time. A new 20-ft. furnace has been set up, and a new blowing engine is being installed to supply the blast. Two new stands of converters with cast-steel heads are being installed, the mechanism of which will be electrically operated. The ores here are not roasted.

PIOCHE, NEVADA.

Jack Rabbit.—Improved Railroad Facilities.—Geology of Day Mine.—Extensive Development.—New Plant.

In spite of the depression due to prevailing prices of silver, lead, and copper, there is much activity in this district. This may be attributed to two conditions: first, the ores of the district are of such character that they may be mined with profit even at prevailing metal prices; and second, that none of our mining men believe that present prices will continue. The bulk of the shipments this year have been from the Jack Rabbit mine of the Nevada Utah. Although located as the Jack Rabbit, and so appearing on the records, this mine is generally known and referred to as the 'Day.' The mine was discovered by Isaac Newton Garrison in 1877, after the decadence of the great properties at Pioche. In walking over the hill Garrison saw a jack rabbit. He stooped down, picked up a rock to throw at the rabbit, and found that he had a piece of ore in his hand. The deposit was soon located and named the 'Jack Rabbit.' It was exceedingly rich on the surface, and was soon purchased by Capt. H. H. Day, who had been manager successively of the Meadow Valley, the Raymond, and the Ely companies. The principal owners were San Francisco men, but Mr. Day ran the mine for years and extracted hundreds of thousands of dollars from the group, other claims having been purchased. It became the custom to speak of the property as 'The Day,' and the pseudonym has survived. When James P. Gaskill, chief engineer of the Nevada Utah, assumed charge of the mining operations for that company on January 1, he concluded that the Day was the most promising of all the properties for immediately profitable output. He has given it his undivided attention since that time. A narrow-gauge railroad nearly 14 miles long connected the property with the broad-gauge branch of the Salt Lake line, opened to Pioche January 1. This narrow-gauge line has been practically re-built, a new engine and other equipment purchased, and for some months there has been a double daily service. It has been bringing in about 100 tons daily from the Day and several standard-gauge carloads weekly for the Bristol Consolidated, which resumed operations several weeks ago. It is the intention of the Nevada Utah to make this narrow-gauge a custom road, and to haul ore and supplies for any company desiring to patronize it.

The Day mine is in Cambrian limestone. The main adit is on the third level. A shaft at the mouth of the third level has been sunk to the twelfth, proving that the limestone persists below that depth. Three fissures nearly vertical and approximately parallel, striking about N20°E, constitute the main vein-system of the Day. These intersect a transverse system of fissures, and also the bedding-planes of the limestone, which dip from 20 to 30°. The ore occurs as a replacement in the limestone at or near intersections with both the transverse veins and bedding planes, and also sometimes follows the bedding-planes for considerable distances from the main veins. The main tonnage is furnished by ore carrying from 10 to 20 oz. silver, 5 to 15% lead, and so high a percentage of iron and lime that at 10c. per unit the iron and lime often come near paying freight charges from Pioche to the smelter. Some weeks ago an irregular orebody of high grade was found. One car of 25 tons was shipped, which netted at the smelter about $118 per ton. Scattered through this body were pieces carrying bromide and chloride of silver, which assayed up into the thousands of ounces, and afforded welcome opportunity for Eastern brokers to indulge in spectacular advertising. Mr. Gaskill is working out a system of development which will make the main working shaft

on the Onodago mine. The collar of this shaft is several hundred feet lower than that of the present working shaft. He is going to add to his plant immediately two large compressors and two boilers, connect one of the lower levels with the Onodago shaft, dispense entirely with the bucket-tram from the third level, and install a powerful hoist on the Onodago. He expects to be able to deliver ore to the bins at a total cost of not over 50c. per ton. This suggests the enormous orebodies in which he expects to mine and the insignificant cost upon which he is counting for mine-timbers. Large as is the tonnage to come from the Day mine, the management of the Prince Consolidated Mining & Milling Co. is confident that still larger bodies of commercially valuable ore exist in the Prince mine, three miles southwest of Pioche. They talk of an orebody 80 ft. wide, carrying an average of 6% lead, 8 oz. silver, $1.50 gold, and 32% excess iron and manganese. This company has recently also found a vein of high-grade ore, running nearly parallel to the manganese ore, which has been explored for a length of about 110 ft. On the south end of the drift there is now 4 ft. of ore. Toward the north there are indications of a system of veins of this character; but further development will be required to determine the extent. From the assays of ore already taken from this vein, the shipping product should show 100 oz. silver, $10 gold, and 30% lead. This company will install at once a new 100-hp. compressor plant.

The same interests which control the Prince Consolidated also control the Ohio-Kentucky, a property of vast possibilities. At present the Ohio-Kentucky Mining Co. is devoting its attention chiefly to the Susan Duster, a silver-lead-zinc property about half a mile south of Pioche. This company is planning to install a concentrator to effect a separation of the lead from the zinc. The same interests also control nearly 200,000 tons of old tailing at Bullionville, about 10 miles southeast of Pioche, where the old mills were located which treated the ores from the Pioche mines in the early days. These interests are working on a plan for a smelter at Bullionville in which the lead sulphide from the Susan Duster and the iron-manganese ores from the Prince shall enable them to smelt their tailing and also to purchase silicious ores from other mines in the district. The Boston & Pioche mine, situated about a mile southeast of Pioche, is in high-grade ore on three levels. This company owns about 4500 ft. on the old Yuba dike, which runs easterly and westerly a short distance south of the great Meadow Valley Raymond-Ely vein. The porphyry dike in quartzite, dipping about 70° south, has three distinct veins, one on each contact, and one in the porphyry. Sometimes only one of these veins carries value, sometimes two, and occasionally all three. It is said that in the early days, when the mines here were all working, one could walk on ore continuously for a mile in this dike. The Boston & Pioche has on each level about 18 in. of high-grade ore, which C. S. Miller, the manager, claims will run about $100 per ton in gold, silver, and lead. There will also be from two to three feet on each level of low-grade ore, which will be reserved for treatment later, when the company erects a concentrator. The company is now installing a new 100-hp. engine and air-compressor.

The Nevada-Des Moines Mining Co. has the head-frame ready for a 40-hp. gasoline hoisting and compressor-plant, which is due to arrive any day. This is the company which took out some cores with a diamond-drill which they claim yielded $1000 per ton in gold. The community is waiting with impatience for the shaft which may confirm this claim, or extinguish exalted hopes. The Nevada Pioche Mines Co. was organized here last week to take over the old Page & Panaca mine, which had a brilliant record in the early days. Some prominent Ohio men hold control, represented by E. Greenwood as manager. The famous Mendha, in the Highland district, has ordered a 40-hp. hoisting and compressor-plant, and will commence shipping as soon as it is installed. The Ely Mining & Milling Co. and Nevada Horn Silver Mining Co. are developing properties which make some gratifying disclosures, and a number of other properties are preparing to ship on a small scale.

BUTTE, MONTANA.

Cost of Producing Copper.—North Butte.—Davis-Daly Estates.—North Butte Extension.

It is asserted by men whose judgment is good that the average cost of Amalgamated copper is below 10c. per lb., including refining and selling. The Amalgamated not only markets its own copper, but also that of the North Butte and the Butte Coalition Co. The two latter companies are mining a quality of ore that for richness has never been equaled in Butte, and but for the fact that they are required to mix with it a lower grade, they could market copper at an exceedingly low cost. The extreme high cost of Butte copper during the past two years was due entirely to the heavy expenditures for immense new plants and improvements. In the case of the North Butte Co. the great amount of exploration and development work ran the cost up, but that work has been carried many years in advance. In the case of the Butte Coalition Co., entire new surface plants of a type that will not require additions or enlargements for many years were installed and charged against production, while the mines were in a frightfully bad condition, left so by the former owners—the Heinze companies—which mined ore during the last year of possession regardless of consequences and reckless as to timbering. In many instances it would have been cheaper to have opened new mines than to pick up and put in condition the old workings. This work was done at great expense, and at the same time extensive development and exploration work was carried forward. All this extraordinary expense was marked up to the cost of production. The mines are now in as good condition as any in the Butte district, and all the extraordinary expense has been cut off. Only the ordinary development work is kept up, and immense new bodies of high-grade ore, much of it copper glance, have been opened. The levels of the Minnie Healy mine will shortly be connected with the new Tramway shaft, when the latter will be used for mining the Minnie Healy below the levels troubled with smoke and fire. The Minnie Healy veins have been cut and opened on the lower levels and the ore tonnage will be more than doubled when the tramway hoist is put in commission. No recent strikes have been made in the Coalition mines, but the ore reserves are showing up larger and richer. There have been reports also, emanating from Wall Street, of new strikes in other Amalgamated mines, but these stories appear to have been manufactured for stock purposes exclusively. No exploration is being done in any of the Amalgamated properties at present, and the development is confined to the veins and orebodies that were opened by sinking and cross-cutting a year ago.

The re-election of the old directors of the Davis-Daly Estates Copper Co., with the addition of three men closely associated in business with, or as employees of, Heinze and Coram, seems to preclude the likelihood of any more confidential relations between the stockholders and the management in the future than in the past. A portion of the public which bought Davis-Daly stock at prices from $12.50 up to $17, has been uneasy over the disclosures concerning the affairs of the company and the discovery that it had no funds in the treasury, when the public was led to believe there were several million dollars in hand. There is something of a question whether the public was tricked or self-deceived. When it was eager to buy Davis-Daly stock it refused to read anything but boom news about the property, and a few items of truth were denounced as 'knocks' and untruths, but it now develops that the stories of immense orebodies opened last year were mostly imagination, as were the stories of a big treasury balance. The company is still pressed for funds, and is carrying on only a limited amount of work.

A 500-gal. pump has been installed on the 500-ft. level of the North Butte Extension, and the water, which impeded sinking for a while, can now be handled easily. A new electric pump for the 700-ft. station will arrive about July 1. It has not yet been definitely decided to cross-cut at the 700-ft. level.

Concentrates.

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

Molybdenum, occurring usually as the sulphide, molybdenite, which strongly resembles graphite in appearance, is commonly found in association with pegmatite dikes in granitic areas. It is also a not uncommon mineral in silicious copper ores in certain districts of Arizona and Canada.

The supporting power of a pile, two thirds of which is in the ground, can be determined by the formula given in Baker's 'Masonry Construction,'

$$P = 100(\sqrt{Wh} + (50d)^2 - 50d)$$

in which P is supporting power, in tons; W, weight of the hammer, in tons; h, height of fall, in feet; and d, penetration of the pile under the last blow, in feet. The test blow must be measured on sound wood, and it is best to use the average of several blows.

Mica occurring disseminated in igneous or other crystalline rocks is commonly an original constituent, whereas when occurring in large masses, capable of commercial use, it is invariably a secondary mineral, resulting from alteration of orthoclase cyanite, corundum, and other minerals, present in extensive segregations. Such alterations usually occur at a considerable depth below the surface, hence the extent of the mica will depend upon the extent of the original segregation.

Arsenic sulphide may be recovered by lixiviation with a solution of soda, according to F. Howles, who describes a process in the *Revue Chimique*. By using the soda or other alkali, sulpho-arsenates of the alkali metal are formed. The solution containing these can be decomposed preferably while warm, by iron or manganese hydroxide; the sulphur of the sulpho-arsenates is thus replaced by oxygen, forming commercial arsenite in solution and a precipitate of iron or manganese sulphide, which can easily be filtered out. The arsenites can then be recovered by evaporation of the filtrate.

Vanadium is sold on the basis of the vanadic oxide (V_2O_5) contained in the ore, the current quotation being 40c. per lb. of vanadic oxide, the minimum amount admissible in a commercial ore being 12%. The commonest ore is the mineral vanadinite, a chloro-vanadate of lead, which contains 19.4% vanadic oxide in the pure state. Descloizite, a hydrous lead-zinc vanadate, containing 22.7% vanadic oxide, and roscoelite, a complex silicate of the mica group, containing over 20% V_2O_5, are also relatively abundant. The latter mineral, occurring in a sandstone at Newmire, Colorado, is being commercially exploited.

Coning ore for quartering requires great care if the resultant sample is to represent a true average. Each shovelful must be dropped upon, not thrown at, the exact centre of the pile, so that it will spread out evenly in radial lines around the cone. The shovel must be dropped away from its burden to accomplish this result. Any toss to the shovelful will injure the accuracy of the sample. In shoveling-over a pile thus coned-up, it is not good practice to drive in the shovel along radial lines toward the centre, as that causes the ore to run toward such a cut and mix irregularly. The ore should be removed in progressively narrowing circles, the shoveler working round and round the pile, driving the shovel along a line tangent to an imaginary circle concentric with the base, and lying a few inches within its outer edge. Thus the angle of rest for the broken ore will be uniformly disturbed, causing the material to flow radially from the centre and so distribute itself as to yield a practically true average. The fine ore and dust remaining in the centre in too small an amount for correct partition with the shovel should be mixed and quartered on a rubber sheet, or piece of new oil-cloth, the proportionate parts being put back with the sample and reject respectively. Careless 'coning' will always give an inaccurate sample.

Cleaning mercury with ferric chloride (Fe_2Cl_6) is recommended by nearly all the textbooks, without attempt at explanation of the chemical phenomena involved. It seems improbable that any benefit would arise if the chemically pure salt were used. The commercial salt contains ferrous chloride ($FeCl_2$), and probably will generally show the presence of free hydrochloric acid, to which we would be inclined to ascribe any office of purification which may be performed. In fact, the use of hydrochloric acid itself is most commonly recommended, which is certain to be efficacious in converting lead and zinc, present as impurities, into chlorides. But ferric chloride in the presence of nascent hydrogen is converted into ferrous chloride and hydrochloric acid, thus:

$$Fe_2Cl_6 + 2H = 2FeCl_2 + 2HCl.$$

By the use of metallic sodium in connection with the ferric chloride, nascent hydrogen is rendered available by the reaction

$$Na + H_2O = H + NaOH.$$

This would seem to be an expensive method of converting the contaminating metals into chlorides, but there is a probable further advantage to be derived from the presence of ferric chloride when other metallic chlorides have been formed from the impurities in the mercury, namely, the extraordinary facility with which ferric chloride forms a double salt with other metallic chlorides. Lead chloride is difficultly soluble in water, but the double plumbi-ferric chloride is readily dissolved. Hence we have here a means of easily removing the chief impurity, which would not be so readily done without the employment of ferric chloride. The natural conclusion therefore is that the simpler and more economical and more thoroughly efficient procedure would be to treat the foul mercury with a strong solution of ferric chloride, acidulated with hydrochloric acid. We have not tried this, and information as to the result attained would be welcome.

Discussion.

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy.

Mining Law.

The Editor:

Sir—I am interested to observe in your columns a renewal of the perennial discussion of the apex or extra-lateral feature of the Federal mining law. I endorse the well-stated and weighty reasons in your editorial of March 14 against the repeal of this provision. Even if the proposed 'square location' were intrinsically better, the confusion of rights and resulting inevitable litigation would far outweigh any supposed advantage.

But, in my opinion, the 'square location' would not, on the whole, be for the best interests of mining nor as nearly do justice as the present system, even if the former had been put into operation at the beginning of mining development. It seems to me justice imperatively dictates that where the miner has discovered or developed a profitable mine out of a vein or deposit, indicated usually only by uncertain and deceptive outcrops, he should reap the full reward of his courage and expenditure by having the right to follow such vein on its dip as far down as it may be profitable. He certainly has a tenfold stronger claim thereto than the surface owner, on the other side of an imaginary vertical plane through a boundary line, who has done nothing to develop the orebody. Incidental difficulties in its application should not be allowed to obscure the essential justice of the principle.

The apex provision has been a fundamental principle of our Federal mining code since 1866, and prior to that had been in existence as an essential rule of the mining customs and regulations which governed mining in the quartz or lode districts from the earliest days of gold discovery in California. This is shown by the complete collection of the rules and regulations of the old mining districts made by Clarence King for the tenth census.[1]

A large part of all law is only custom adopted either tacitly (common law) or expressly (statutory law) and enforced by the State. It is a fact in the history of jurisprudence that those laws which have thus originated in custom have generally been the ones that have given satisfaction and accomplished justice so far as any law can do this. The adoption of the customs, rules, and regulations governing mining in the early days in California and adjoining territories was a true example of the development of a 'common law.' It continued in this unorganized form for nearly twenty years before being enacted into statutory law by Congress. Is it not unreasonable to suppose that although unconstrained by any statutory law on the subject, and in a pioneer time when all social and business institutions were in a particularly plastic and unsettled condition, these adventurous and untrammeled miners would have adopted in all districts this principle to regulate their property rights, and have maintained the same for nearly two decades and finally asked and secured through their representatives in Congress its enactment into a statute, if it were not the best rule for existing conditions?

But has the advance of geological knowledge concerning veins and ore deposits or the enormous modern extension of mining operations rendered the apex law unsuitable for our own times? I do not believe so. During 1907 a discussion was carried on in *Economic Geology* on the topic 'Do the geological relations of ore deposits justify the retention of the law of the apex?' in which Chester W. Purington, Courtenay De Kalb, and other prominent mining men took part and adduced the specific geological instances in which they claimed the apex law worked injustice. It is to be presumed that they presented the strongest examples they knew, and their standing makes it extremely probable that their knowledge included all important objections.

In a contribution to this discussion[2] I have analyzed these instances and have shown, as I believe, that in each case the objection was not valid, being based either on fallacious reasoning on the assumed geological facts or on a misunderstanding of what the law really is applying to said assumed facts. Mr. Purington, in particular, has been especially hostile toward the apex law, but although a year has elapsed he has allowed my arguments to stand unanswered. The other participants have done the same. This, of course, does not prove that the said arguments are unanswerable, but I believe that if they had seemed vulnerable, they would not have remained so long unchallenged.

I only mention this because, from lack of space, it is impossible to cite and discuss such instances in detail here, but it is on such concrete examples that our general judgment of the desirability of the apex law must be founded, rather than on the casual suggestions or unsupported assertions of men untrained in jurisprudence. Consequently, it seems to me, not only do the weighty considerations of the confusion and unsettling of existing rights, etc., stand against changing the long established policy of the mining law with regard to apex or extra-lateral rights, but also the more fundamental considerations of adaptation of the law to secure the largest possible measure of justice, both in pioneer times and under modern conditions, are likewise opposed to change in that respect. I think that if Mr. Tays attempts to furnish concrete instances of the "absurdity" of the apex law's operation, he can do no better than Mr. Purington *et al.* Mr. Turner seems to think it an argument against the apex law that placers are located under a 'square location' provision, but this argument is entirely fallacious, for the geological conditions in a placer deposit are entirely different from those in a vein or lode deposit. In regard to the Leadville cases, it was not because "confusion worse confounded would have resulted from its application" that the apex law was, in effect, nullified, for that locality, by the uniform decisions of the juries that the blanket deposit there found extending under different claims, was not the same vein in the

[1] Report Tenth Census, Vol. XIV, 'Mining Law.'

[2] *Economic Geology*, Vol. II, p. 62.

different claims, although scientific opinion was otherwise, but because of the intense local feeling against allowing the outcrop locators to monopolize the extensive deposits that could be readily reached by shallow shafts from the surface in other claims. The like has often happened to other excellent laws. For example, the State law for Sunday-closing of saloons is absolutely nullified in Chicago because no jury (which the violators have a right to demand in every case) can be secured that will convict, on account of local sentiment against Sunday-closing laws.

It is admitted that the provisions of the apex feature of our Federal mining law are rather vague and left many points uncertain, but this was inevitable in the primitive conditions of geological knowledge and mining development then existing. This indefiniteness, however, has been removed by the decisions of the courts during the period of over forty years since its enactment. By a kind of judicial lawmaking, consisting of the application of the necessarily general provisions of the statutes to the concrete facts and relations of the real cases, a definite and sufficiently elaborate set of legal rules have been evolved to meet practically every contingency in mining operations.[3] Of course, the difficulty still remains in each case of ascertaining what the geological facts are in relation to a given mine, but the same exists in all legal disputes, particularly those involving technical and scientific subjects. It has unfortunately cost considerable expensive litigation to accomplish this, and to that extent the critics are justified in their strictures, but it was simply impossible that it should be otherwise, for the complexities of veins and other forms of ore deposits could not possibly have been foreseen when the law was enacted.

I seriously doubt the advisability, at this late date, of attempting to modify the present law in any particular, although with our present knowledge of ore deposits, if the law were now first proposed, I would advise an attempt to define and exclude 'blanket' deposits, and also fix the status of ancient buried placers, which is still uncertain by reason of conflicting decisions thereon by the lower courts. The entire repeal of the apex or extra-lateral principle would, I believe, be a positive misfortune to our mining industry.

CHARLES H. SHAMEL.

Springfield, Illinois, April 28.

Separation of Slime.

The Editor:

Sir—The article in your last issue by Horace G. Nichols on 'The Separation of Slime in Cyanide Treatment' is of great interest to millmen generally. The devices used will not only simplify and reduce costs of cyanide treatment, but they will give to millmen a reliable and efficient de-watering device.

In the fall of 1906, while building a concentrating mill in a region where water was scarce, I had occasion to look up the various water-saving devices. None that were submitted promised to be satisfactory, and the best results obtained were said to be the treatment of one ton of ore with a loss of half a ton of water. I then designed, but did not build, a device very much like Mr. Nichols' tank, through which a conveyor belt was to run for the purpose of removing the final tailing from our concentrator. I did not expect, however, to secure such results as Mr. Nichols has obtained: the removal of 94.97% of the tailing with a loss of 31.3% water, and all of the tailing with a loss of 36.07% water. In this case there was a large percentage of slime, much greater than there would be where the ore is not treated by cyanide. The concentrating plant I was building was designed to make but a small percentage of slime, less than 10%. This mill has not yet been completed. In view of the facts, it would seem that Mr. Nichols' device is the best dewatering scheme available, as it is safe to figure that by its use a ton of ore can be crushed and concentrated with a loss of but 500 lb. water.

G. McM. Ross.

Stockton, April 29.

Gasoline Connections for Assay Furnace.

The Editor:

Sir—As a means for conducting gasoline to an assay furnace, I beg to describe a method which is original so far as I know. I made use of a 20-ft. length of hollow wire, or tube, of copper alloy, ⅛ in. diam. on the outside. At each end was placed a combination ¼-in. valve and union. One valve was placed directly on top of the pressure tank, the plug being tapped to receive it, and the other valve screwed into a short piece of ¼-in. pipe, using a sleeve-coupling. This piece of pipe, about 1½ ft. long, led to the burner. The gland nut being placed on the wire, the glands were silver-soldered at each end. This obviates all risk of the solder melting, especially at the burner connection. For a pressure tank I made use of an 18-gal. water cylinder, tapping out the water and air plugs for ¼-in. pipe connections. A piece of cotton wicking was inserted at the upper end of the ⅜-in. pipe inside of the tank to serve as a filter for the gasoline before going through the wire. This scheme possesses the following good points. It has no leaky joints, is easily set up or taken apart, is not as heavy and cumbersome as the usual ¼-in. pipe-connections, and there is less chance of spilling gasoline in case of accident to any part of fittings outside of the pressure-tank. The hollow wire employed is that used so extensively in gasoline lighting, and can be purchased anywhere.

HERBERT W. CUMING.

Victor, Colorado, April 24.

Mine-Fires.

The Editor:

Sir—In your issue of March 28, W. O. Snelling proposes the use of sulphur dioxide as a means of fighting mine-fires.

There are some cases where this might be of no avail, as the gas is a supporter of combustion itself in the sense that it is reduced by incandescent carbon. This reaction is the basis of the original patents of Schroeder and Haenish for the recovery of

[3] See chapters XIII and XIV of my book 'Mining, Mineral and Geological Law' for a statement of the rules resulting from an analysis of the decisions on the apex or extra-lateral law.

sulphur from furnace-gases. It is also employed in my own processes, while Paul I. Smith makes use of water-gas. In other words, incandescent carbon from burning mine-timbers will continue to burn in an atmosphere of sulphur dioxide, and the reduced sulphur might 'burn' in some other part of the mine, thus prolonging the trouble indefinitely.

FRANKLIN R. CARPENTER.

Denver, April 14.

The Mining & Metallurgical Society of America.

The Editor:

Sir—The comments on the charter and by-laws of the new society appearing in your issue of May 2 are quite likely to be misunderstood by those not intimately conversant with the aims and objects of the Society and the relation of these to the American Institute of Mining Engineers. The statement, "let the Institute work the lode that it located, patented, and developed thirty years ago," may perhaps better be understood by reference to the location notice posted in May, 1873, which reads:

"The objects of the American Institute of Mining Engineers are to promote the Arts and Sciences connected with the economical production of the useful minerals and metals, and the welfare of those employed in these industries, **by means of** meetings for social intercouse, and the reading and discussion of professional papers, and to circulate, by means of publications among its members and associates, the information thus obtained."

While opportunities to amend this certificate were afforded in 1875, '77, '78, '80, '81, '87, '90, '96, 1903, and 1904, when the Rules governing the business of the Institute were amended, this original notice remained unchanged and became the final certificate of location, as stated in its Certificate of Incorporation finally adopted in this form February 21, 1905. The tendencies of the rules and amendments adopted from time to time have been to construe this statement of objects literally, i.e., to restrict the activities of the Institute to the **reading, discussion, and publication of professional papers**; to limit, rather than to expand, its functions, so that by thirty-five years of practice and precedent the extent of its territory is now well defined. In other words, it has disavowed all claims to "dips, spurs, angles, cross-veins," etc., confining itself strictly to the one lode, and to that within definite boundaries.

Hence the adoption by the new society as one of its objects, "the increase of scientific knowledge," does not imply trespass upon territory to which the Institute has acquired exclusive rights; for there are many ways of increasing scientific knowledge other than by the publication of professional papers; and further, the Institute has for many years permitted others to enter its territory and to work its ground as tenants in common.

The clause above quoted will enable the Society, if it so desires, to **encourage original research** (it was in fact substituted for these words); to embark upon the **collation, condensation, and classification** of useful data, in tabular, periodic, or encyclopaedic forms; to **conduct investigations** through committees appointed for that purpose; to **offer premiums, medals,** etc., to stimulate and reward scientific discoveries; and to assist in securing scientific work by or through governmental agencies or support.

In some or all of these directions the Society should become a useful and valuable organization without duplicating any function which the Institute has heretofore performed.

If the Institute actually control the publication of all technical articles connected with the mining and metallurgical industries, a valid objection to the new society would be that it might invade this field; but the field is already divided, for other scientific societies and the technical journals and periodicals obtain many professional papers that should go to the Institute if the Transactions of the latter are to embrace all literature of this kind. As a matter of fact, the annual publications of the Institute embrace but a small fractional part of current American mining and metallurgical literature. In this connection it may be interesting to note the effects of the growth of the Institute, and of the industries and population of the country, upon its work. In 1875-77, with 400 to 500 members, its publications annually comprised 500 to 600 pages; in 1890-92, with 2000 members, representing industries which had tripled in value of output, its Transactions embraced about 1000 pages, and in 1906-07, with 4000 members, representing enormously enlarged industries, its Transactions include about 1100 pages of technical matter. It is, therefore, evident that while the Institute has grown in membership somewhat in keeping with the growth of the population and industries of the country, its publications have kept pace neither with the number nor with the activities of its members. In other words, its importance as a bureau for the publication of technical papers has relatively diminished, the field having been invaded by local and specialized organizations of technical workers, and by the increased number and enterprise of technical journals and periodicals. If the Institute is to retain its prestige in this field, it must be prepared to meet the competition of the technical journals and of technical societies such as the Chemical Society, the Electro-Chemical Society, the new American Iron & Steel Institute, the Canadian Institution, the Coal Mining Institute of America, and many local engineering and scientific organizations. It need not fear active rivalry from the Mining & Metallurgical Society of America.

H. M. CHANCE.

Philadelphia, May 8.

A Matter of Ethics.

The Editor:

Sir—Your very interesting discussion of the Yukon Gold flotation leads me to request through your columns an answer to a question of professional ethics. It is currently reported that while Lawson was making a market for the Yukon Gold stock, Mr. O. B. Perry and some of his associates sold some of their shares in that company to the public. My question is this: At a time when the report of a mining engineer is being invoked by his employers to establish

a certain market valuation for a mine, is he justified in throwing his own shares in that mine on the market? He sees his report used to convince the public that the mine is a good buy at a certain price, and he does not publicly protest against such a use of it. But by his actions he seems to say that the mine is a good sell at that price. Is it right for him to be acting on both sides of the market at the same time?

SOCRATES.

San Francisco, April 28.

[This is a delicate question. We are not sure that even 'Socrates' has all the facts. If the engineer was not consulted as to the transaction in which stock was optioned to a promoter, and if the stock was placed on the market at a price two or three times the valuation warranted by the engineer's own report, it seems logical for him to sell, and thereby warn the public. If it is proper to buy shares in the mine on which you report, it is also proper to sell when the price becomes highly speculative. We are not aware that in this case the engineer was acting "on both sides of the market": it will probably be found that he was not a party to the attempt to create a market at a fictitious price and if he thought the shares were not worth $7.50 to $9, he was perfectly logical in selling stock that he probably got at $3. If mining companies encourage their engineers to buy stock, they are estopped from complaining against the selling of that same stock whenever the price becomes inflated.—EDITOR.]

Value of Mining Stock.

The Editor:

Sir—The question discussed by Mr. M. L. Requa in a recent issue regarding the measures necessary to clothe mining stocks in a garb that will commend them to the eye of a banker as collateral, is one that deserves a practical solution. History has indeed invested these mining stocks with a character not calculated to encourage intimate acquaintance, and if any method can be devised by which they may hope to make a better showing, that method would certainly be most welcome to business men who have regard for decent appearances. It is not only, as Mr. Requa indicates, a matter of satisfying a banker's requirements for a collateral, but also the broader question of commending such securities to the investor with something more than the embellishments of printer's ink.

Before suggesting any means whereby improvement may be effected it will be necessary to analyze in some degree the conditions under which mining stocks in general come into being. In this aspect it will be found that they bear too close a resemblance to the human family to warrant the hope that there will ever be such general and universal amelioration as to impart a uniform character of moral and physical perfection to them. This is not apparently what Mr. Requa anticipates, but what he would like to see is some modification of the bankers' attitude, which excludes all mining stock from the list of acceptable collaterals. And in this connection he sees another deplorable fact in that "not one of the great mines of the West is controlled in San Francisco," which might indicate that there is not one capable and honest man in San Francisco, or if ever there was one born and brought up in that city he was captured and taken away to New York or London!

While rightly claiming the normal process of evolution in the development of mines from prospects, Mr. Requa seems to regard as necessary to the rudimentary stage "excitements, booms, stampedes" and "wild-cats," but regards as unfortunate the fact that the "first period is merged into the second," that is, in the opinion of the public, which fails to differentiate between the multitude of wild-cats and the thoroughly proved mines. It may fairly be questioned on logical grounds, whether such differentiation is to be expected, or even whether it is justified by the facts. Unfortunately, tendencies abide, and what are born as 'wild-cats' mature, if they mature at all, as manipulated stocks of developed mines.

This classing of 'wild-cats' and 'prospects' as necessary correlatives in mining, may be the prenatal influence that determines the after conditions which Mr. Requa rightly deplores. Is it not the wild-cat nature that has for many years directed the policy of mine promotion in San Francisco? That unfortunate city has had to bear the stigma of many evils, which in its regeneration it is striving manfully to cast off, and if this wild-cat evil, along with other evils, can by any means be discarded, it will be a consummation devoutly to be wished. But is it consistent to absorb fool money for prospect mining, and then solicit wise money for the developed mine? Is it rational to expect anyone to differentiate between the period of rascality and the period of honesty in the growth of a mine?

Will "systematic reports" remedy the evil? Is it not the absence of confidence in the methods pursued throughout the entire career of mine creation and activity, rather than the want of "reports," that operates most severely against the acceptance of mining stocks by bankers and sane investors? A systematic method of reporting to stockholders regarding the affairs of a mining corporation is certainly a crying need: and not only so, but methods should also be devised whereby such reports could be received with the practical assurance of accuracy. Publicity would seem to be the least requirement to be expected from such corporations as subsist on public subscription, and in its application, mining corporations may well be included with those of banks and railroads. Under present conditions it is doubtless true, as Mr. Requa states, that such reports would probably act as a boomerang. Doubtless the Stock Exchange might render valuable service to the cause of legitimate mining, but here again it would appear that measures of reform are in order.

As before indicated, some sort of classification of mining stock appears necessary, and that along pretty well defined lines, in order to arrive at a comprehensive understanding of the situation. The question of qualifying mining stocks for use as a bank collateral by creating conditions necessary for their production, remains to be definitely answered.

Mr. Requa names concisely the necessary characteristics of such stocks, and answers the question whether it is possible to meet the tests by an emphatic "Yes," and follows up his affirmation by designating three conditions which, if fulfilled, would solve the problem.

Permit me to ask, would Mr. Requa himself travel the road he indicates? Can a mine-owner be found who will consent to a capitalization of his property, based on the findings of the tape-measure, the assay-office, and the cost-sheet? I doubt it. Not that I question Mr. Requa's sincerity, but because I think he goes beyond what in practice might be fairly considered as just to himself. I think he concedes too much to the demands of the banker. Not that I desire to weaken the banker's security, but I doubt, even if all were granted that Mr. Requa is willing to concede, whether the banker would be quite satisfied. I humbly express the opinion that the desired end, if it can be reached at all, must be reached by some other route. The situation appears to require that an organization be formed which will undertake to create the necessary conditions for imparting to an issue of mining stock those elements of reliability and stability which will bear scrutiny, both for investment and for collateral purposes. This must be undertaken with a thorough understanding of the peculiar conditions that are inseparable from mining, in contrast to any other industry or financial institution. In a word, it is a question of adapting a financial scheme to the exceptional requirements of legitimate mining, in which the public is to be interested.

The ideal conditions under which mining is conducted are those in which a corporation, composed of half a dozen men, or less, has all the capital it requires without borrowing, has its own mines, large and rich, and goes ahead and extracts the mineral from the earth in its own way, and keeps its knowledge to itself.

While there may be a few corporations thus happily situated, the majority of mining companies, even of the reputable class, must deal with the public, and this is certainly a proper field in which to operate, and to achieve success on legitimate lines, but it must not be forgotten, as Mr. Requa points out, that differentiation is necessary in determining the relative merits of mining stocks, and in order to facilitate that process the following classification is offered in a suggestive spirit:

1. Wild-cat—Numerous, deadly, cannot be killed, to be avoided.

2. Prospect—Speculative; if successful, profitable. Not suited to public subscription.

3. Listed Producers—Subject to manipulation, or closely held. For investment purposes, difficult to discern good from bad. If good, rarely obtainable.

4. Unlisted Producers—Held by close corporations. Highly developed. Inaccessible to public.

5. Investment Producers—Operated under central management. Successful if in the hands of capable and honest men. Safe, if properly financed. Best adapted for public participation. Very rare.

Berkeley, April 23. INVESTOR.

AN ACID-RESISTING ALLOY.

According to a paper by A. Jouve, presented at a recent meeting of the *Société des Engénieurs Civils de France*, the chemical industry is to benefit materially by recent advances in the study of alloys of iron and silicon. The great difficulty in the manufacture and concentration of acids has been the lack of a satisfactory material for the construction of the vessels in which they are produced. Recent investigations, of which the following abstract of M. Jouve's paper gives a brief outline, have revealed in certain metallic compounds in which iron and silicon are the predominating elements, a combination of properties which apparently will remove the most troublesome and costly features of acid manufacture.

The ordinary materials used, such as glass, porcelain, and stoneware, are both fragile and limited as to possible size. Alloys of platinum and iridium, or platinum and gold are used, but their cost is high, and the consumption of platinum by the acid increases rapidly with the degree of concentration. Lead cannot be used for concentration above 60°B, and cast iron is attacked by dilute acid.

The researches of M. Jouve were based on a laboratory observation of the difficulty of dissolving iron-silicon alloys in acids, a difficulty increasing with the percentage of silicon. The acid-resisting properties of these alloys immediately suggested their utilization for the construction of appliances for acid manufacture. The alloys experimented with were complex metallic silicides of high silicon-content, in which the silicides of iron formed the principal part of the mixture. After a compound with the necessary acid-resisting qualities had been produced, great difficulties were met in giving it qualities by which it could be cast in desired forms, particularly when handled in large masses. This was accomplished by the addition of certain other substances to the compound of iron and silicon. M. Jouve does not say what these substances are, that remaining a trade secret. Their use, however, produces a metal which fuses readily and takes the mould perfectly. The product is in successful use in the concentration of sulphuric acid and in the condensation of nitric acid vapors, in France and other European countries.

Volcanoes standing in such perfect alignment as to indicate that they constitute vents along a straight dike or fissure are rarely found in any considerable number, hence the report of Henry G. Ferguson in the Philippine Journal of Science for February on the 'Physiography of the Batanes Islands,' is of great importance. The following vents, many being active, with their corresponding longitudes, constitute a truly remarkable ease: Y'Ami, lon. 121° 58′; Mabudis, 121° 57′; Inem, 121° 57′; Iraya, 122° 01′; Balintank Rocks, 122° 08′; Babuyan Claro, 121° 56′; Camiguin, 121° 52′; Didicas, 122° 09′; and Cagua, in northeastern Luzon, 122° 04′. The author remarks that this close alignment of the volcanoes of the Babuyanes and Batanes groups, and the supposed fault between Sabtan and Ibujos, suggest the existence of a great north and south fissure, and he reverts to the theory of oceanic stimulation of volcanic activity.

MR. MURPHY ON THE NEW SOCIETY.

Written for the MINING AND SCIENTIFIC PRESS
By An Occasional Contributor.

(*With apologies to everybody.*)

"I see be th' pap'rs," said McCarthy, as the shift-boss disappeared down the next man-way, "that they do be formin a new sassiety f'r mining injineers."

"Yis, I saw it, too," answered Murphy, as he sat down on a candle-box to light his pipe.

"What do it be all about, do ye moind?"

"Well, I'll tell ye how it looks to me," said Murphy. "There's a la-ad back in Philadelphy by th' name iv Chanee, who's belonged to me frind Ross Raymond's sassiety so long he f'rgot whin he jined: an' one day whin th' byes was a little slow about bringin' in pieees iv slate soaked in our Uncle Jawn D's extry water white, an' payin' money f'r him to tell thim that while it wud burn, it was no good, he got t' thinkin about how Rossiter had niver ast him t' be prisidint 'r sicritary 'r nothin iv his sassiety, and he got in a foine frinzy.

"So he made him a little dummy stuffed with hay, an' with white side whiskers an' glasses, an' thin gave it a bat alongside th' head that knocked it as fur as yon stull, an' says, 'Why don't ye do somethin worth while, instid iv dodderin around with ye-er books?' he says. 'Why don't ye assay th' ore iv th' poor'r prospeckter, and deeskiver anither Tonopah?' he says. 'Why don't ye boss th' govermint more, an' make Tiddy tell Jo Cannon what t' do?' he says. 'Why don't ye git busy like me frind Ralph Pope on th' nixt flure t' ye, who has his elictrical sassiety diskussin' ithics, an' actin like me deer Alfonso an' me deer Gaston till ye can't rist?' says he. 'Why don't yet git afther thim fellies out in Nevay-dy who're coaxin good money out iv th' peeple that we ought t' be gittin?' he says. 'Why don't ye have min in ye-er sassiety that amount t' somethin, anyhow?'' says he. 'Sha-a-me on ye!' he says.

"An' thin he gits out his book iv mimbers iv th' Ameriean Institoot, an' runs his finger down th' list iv names, an' picks out a bunch iv fellies like himsilf, an' says he will firm a sassiety that will mane somethin, an' he invites thim all t' be charther mimbers.

"He sinds word t' thim too iditor la-ads Ingalls an' Rickard, that they're invited t' jine, f'r fear they'll be afther knockin his sassiety in their pap'rs, if he don't, but they're hard la-ads t' handle. Th' la'ad Ingalls raytires t' th' sayelushun iv his idaytorial sa-angtum, which has all th' daystinekshun an' individoolity iv me locker in th' dry, an' writes a foine sareastic arthiele abont th' new sassiety, an' thin takes it in an' shows it t' his boss Hill, t' see if he will stand f'r it. Hill looks up th' la-ad Chanee in his eard index, an' foinds that he earries an advertismint in wan iv his pap'rs, an' subscribes f'r anither, so he takes his blue pincil an' mar-rks up th' arthiele till ye wouldn't know it.

"Th' la-ad Rickard, though, is his own boss, or says he is, an' he goes jumpin an' barkin at th' new sassiety like a pup at a sthranger intherin th' yard. He's a strong hand with a pincil, an' slings English loike it was his mither's tongue, instid iv th' lingo thim Cousin Jacks do be talkin, and he's a hard wan t' make shut up.

"But th' la-ads all git t'gither finally, an' e'ngrathulate aich ither on bein' charther mimbers iv th' grate new sassiety they ar' t' form, an' they dhraw up a constitooshun an' byelaws. They make officers out iv th' iditor chaps, so they will kape quiet, an' stop their knockin.

"They sind a committy t' see me frind Ross Raymond, so as t' fix it all up an' be good frinds, an' print their stuff f'r nawthin. But th' old bye is wise t' their game, an' shows thim out th' back dure.

"So they says t' thimsilves: 'We'll take out a pat'nt on a new brand iv ithics, that nobody ilse can use without our sayso'."

"What is this ithies they do be talkin about?" interrupted McCarthy.

"Well, I can't exaetly tell ye what it is," said Murphy, "but I'll try t' tell ye what it does. Suppose ye do be sittin in a little frindly game, an' ye think ye have dilt th' ither la-ads three eards aich that are aloike, an' ye find t' ye'er surprise that ye have a full hand ye'ersilf, it's ithics that fills ye with foine noble sintimints, an' restrains ye-er hand f'rm its deed iv slaughter, whin a frind signs ye that thrn a mistake wan iv th' other la-ads has foor iv a kind.

"Well, these la-ads that are formin th' new sassiety throws out the'r chists an' says in th' pap'rs t' th' la-ads that are scatthered over th' country too busy runnin th' mines t' pay much attenshun t' what is goin on: 'If ye are not mimbers iv our sassiety,' they says, 'ye are no good,' they says, 'an' we don't intind t' let ye jine,' they says."

"Is Tom Lawson a mimber?" said McCarthy.

"I dunno, but if he ain't he ought t' be. He has been th' subjeck iv more ithieal diskussions in th' past tin years thin annywan I know iv."

Gold in Hungary has been produced by native diggers on the banks of the river Drau for several hundred years, and at the present time, according to an account by A. von Gernet, in the Bull. I. M. & M., there are some 200 men earning their living at this work, which is being performed by most primitive methods, with an average yield of from 2s. to 3s. per day per man. Recently, a firm in Vienna obtained the right to exploit the gold-bearing gravel for a distanee of 25 miles between Zakany and Visvar. The river is shallow, wide, and rapid, and consists of several channels having a maximum depth of 10 ft., forming a number of islands. The surrounding country for a width of from one to two miles, as well as the islands and the river bed, are of gravel, and at certain seasons are covered by from 3 to 5 ft. of water. At such times the stream flows about 4 ft. per second, and changes the aspect of the river by forming new islands and channels. The gravel generally is 25 ft. deep and rests on a bed of clay. The upper 6 in. of gravel frequently carries from 1s. to 1s. 6d. per ton, the value diminishing in depth until at 2 or 3 ft. it is only 1d. or 2d. per ton. It is of interest to note that rich places, after being worked out, become enriched again at the flood, a phenomenon common in some auriferous streams.

MEXICAN NOTES.

Written for the MINING AND SCIENTIFIC PRESS
By MARK R. LAMB.

The accompanying photographs will serve to present a contrast between the old and the new arrangement of treatment-plants in Mexico. The great majority of mines now in operation in Mexico are old, and are under American management. Americans having taken abandoned mines and those that have been presumably worked unsuccessfully by others.

Fig. 1. In the Patio.

Modern methods and machinery are doing their part in the development of Mexico, but even an American manager cannot make some mines profitable. In estimating the value of some of the larger mines a few years ago, when silver was high, the engineers supposed themselves perfectly safe in estimating silver at 65c. per oz. Today's quotation is 53c., with a drooping tendency. In Mexico City one hears almost nothing in hotel lobby club but such remarks as:

"Mexico must be put on a silver basis again or the nation will be bankrupt."

"Silver is the main support of the Government, and what will the latter do when mines and mills close down?"

"India will soon resume coinage of silver and the price will go up."

"China's buying will raise the price."

"The present supply of silver is not equal to the demand."

The same remarks, with variations, were made when silver dropped in the United States, and with about the same proportion of truth and error. Silver is produced now at a lower cost than ever before. MacDonald gives the cost of the tedious patio process as ranging around $25 when a Mexican dollar was equal to a gold dollar. Treatment took such a length of time, sometimes more than a month in the patio alone, that the crushing department was small and insignificant compared to the area required for amalgamation. At the present time, when the cost of everything used is higher, including mules, men, fodder, and corn, the patio would absorb even a larger proportion of the ore-value than does the smelter, with no one the better off for it. At Guanajuato and Pachuca, where the process flourished, the site for a *hacienda* generally consisted of the steep side or wall of a gulch, part of which had to be leveled off to prepare the extensive yard or patio. When a cyanide plant is built in the *hacienda* where the *torta* underwent amalgamation, this extensive paved area serves excellently as a site for leaching and agitation-vats. Such a prepared floor is shown in Fig. 1. No more work than necessary is done in preparing the old

Fig. 6. Rurales on Dress Parade.

Fig. 2. The San Matias Mill.

hacienda for the new plant, and so we find steel vats and electric motors surrounded by thick high stone and adobe walls (Fig. 2 and 3), which serve no better

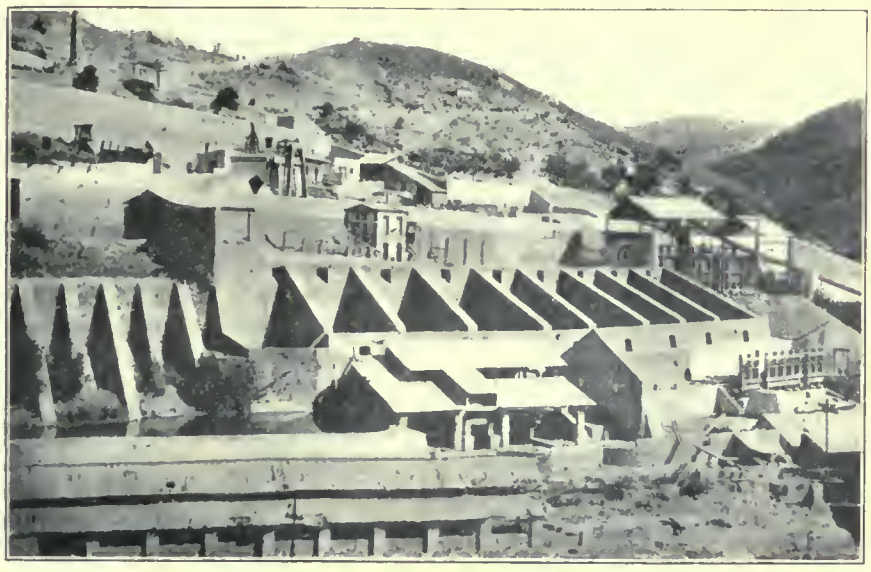


Fig. 3. Ore-bins and Stamp Mill.

than a wire fence in these days of peace and security. However, in many places in Mexico, where labor is cheap and freights are high, it is cheaper to build a stone wall than a wire fence. In Guanajuato good masonry costs about $1.6 per cubic metre, a stone wall built with mud instead of lime mortar is cheaper, while an all-adobe costs less. These walls and their corner lookouts (No. 4 and 5) are provided with narrow rifle-slots which served well in defending the *hacienda* from the assaults of bandits. In one old *hacienda* are still standing at frequent intervals

Fig. 5. The High Noria.

Fig. 4. Ancient Aqueduct.

around the grounds, two-story square towers with radial slots through the walls. An old water-carrier, who thirty years ago was a guard, tells thrilling tales of assaults from without and of robbery from within. "Ah, Señor," he said, "you should have seen the guards who were occasionally caught assisting the *bandidos*!" He smiled at the pleasantly exciting recollection. "They were lined up against the wall and given their just dues. Several times have I been distinguished by being singled out of the firing squad to give the *tiro de gracia* (the final shot), given when some of the squad have been awkward or nervous, due perhaps to having a relative to shoot!"

Sometimes there was a second guard to watch the watchmen. This second *velador* wandered armed through all the plant, watching the guard and the workmen closely. It was a difficult berth, as in case of an assault from without, he was an easy mark for any peevish guard in a tower. "The *patron* was certainly master in those days," the old carrier went on. "Do you suppose he would condescend to converse with a common *peon* such as I, as you are doing?" he asked, watching me scornfully out of the tail of his eye. "*Peones* are to be given orders and are to work, but are not to be associated with." He adjusted the strap of his large *cantero* (clay water-bottle) over his forehead and complainingly lifted it. "In the old days I received 20 centavos for a bottle of water at the *hacienda*. Now, with these *malditos* water-pipes on every corner I rarely receive 4 centavos. Why," as a parting shot, "if it were not for the crazy Americans who pay me 10 pesos for these

bottles which cost me one peso with all and harness, I would be really poor!" This last he said after he had bitten the coin I had given him for his information! One of the little watchman's towers was pointed out to me by an old inhabitant of a deserted mine as still containing bombs and hand-grenades. We could see these through the rifle-slots and with little persuasion the old fellow produced pick and shovel, with which we dug away the fallen wall which obstructed the entrance. The bombs were there in piles—made of quicksilver flasks, sections of pipe, thick clay vessels, and special castings, some loaded and some empty. The fuses looked a little too old for safety, so in several of the bombs the old fuse was replaced by a new one, which was lighted. The effect was sufficient to inspire profound respect. We judged that the result of their use in times past must have amply repaid the expense. It requires little time to find big lead bullets in the walls near these port-holes, and I chose to believe that they were the original messengers from envious anarchists of the last century—anarchists until President Diaz disciplined them. These former terrors of Mexico, since re-enforced by younger blood, now play the part of rural guardians of the peace—*rurales*. They are guardians, moreover, whom it is best to treat with the utmost consideration and attention when they most respectfully request information as to your business and destination, along the highway. This is particularly true if you are evading regulations, such for instance as carrying arms without a permit from the police chief of the district when this is required. The story is told that a few years past, when bandits became temporarily bold, a chief of *rurales* was sent to this district with men and instructions to clean out the outlaws, who were attacking the bullion-trains.. This gentleman was thrown on his own resources. Results were wanted, and he had to find the method. His men were posted on the various roads and arrested suspicious characters, bringing them before the chief. He himself, meeting a suspicious *peon* on the road, might question him as follows:

"What is your name and for whom do you work?"

"Señor, I am Juan Soto. I am *vaquero* for Don Luis."

"*Vaquero*, eh? Let me see where the horse-back riding has callousd your legs."

The *peon* exhibits his bare legs, which have never known a pair of pants, and if the signs are right he goes on his way safely. If not, a revolver shot made one less bandit—probably. And what of an occasional mistake? Such a process would do wonders in certain parts of our most civilized United States. With this story in mind it can be easily believed that the bandits soon became discouraged. The *rurales* make an efficient police. On dress parade (Fig. 5) the leather of the saddles and bridles appears to be merely a foundation for a superstructure of silver. Immaculate tall white Mexican hats covered with silver, tight leather pants, and short leather coats similarly covered with silver, make a costume which is not ungainly and with which no other uniform in America can be compared for beauty.

PREVENTION OF RUSTING.

The scientific reasons for rusting, and the conditions under which it occurs, are well set forth by W. H. Walker in the *Iron and Coal Trades Review*. He says, when a plate of iron is immersed in water positive and negative areas of greater or less extent relatively are developed. It is possible to conceive two cases as occurring among all the possible arrangements of positive and negative areas. The first case would be that of a positive spot surrounded by an extended negative area, and the second would be of a negative spot surrounded by an extended positive area. At the positive areas iron will pass into solution and rapidly oxidize to the loose colloidal ferric hydroxide and oxide which are known to migrate, under the influence of electrolytic action, to the negative poles. In the progress of the rusting under water it would be expected that in the first case the ferric hydroxide would be piled up in a crater with the metal eaten away at the centre, while in the second case the hydroxide would form in a conical mass with the surrounding metal eaten away. These two formations do occur on every sheet of iron that has rusted under the water. According to the electrolytic theory, all substances in solution which contain hydrogen ions should stimulate the rusting of iron, and all substances which develop hydroxyl ions to a certain extent inhibit rusting, and, if the concentration be sufficient, absolutely prohibit it. This application of the theory is borne out by the behavior of acids, salts of strong acids, and weak bases (which hydrolyze in solution or decompose to an acid reaction), and by the alkalis or salts of strong bases with weak acids.

It has been long known that solutions of chromic acid and potassium bichromate retard the rusting of iron. Experiments have shown that iron immersed in a $^1/_{640}$ normal or stronger solution of the latter will not rust. It has been observed, too, that if a rod of bright iron or steel is immersed for a few hours in a 5 or 10% solution of potassium bichromate, and removed, thoroughly washed and wiped, and then immersed in water, rusting is prevented for a length of time averaging from a few hours to weeks. Cushman explains the effect as one of polarization produced by the separation of oxygen from the solution and its retention on the surface of the metal in some way without the formation of an oxide. If, as the electrolytic theory assumes, rusting is due primarily to the exchange of hydrogen ions, iron in the condition of an electrode, polarized with oxygen, should be protected from electrolytic action for a greater or less time, depending on the amount of polarization. There is little doubt that all conditions which interfere with electro-chemical action also inhibit rusting of iron, which fact in itself argues for the electrolytic theory.

Traces of moisture in such fluids as alcohol, ether, and so forth, may be detected by the use of colorless potassium lead iodide. If water be present in the minutest traces it will decompose the double iodide into its components, the lead iodide giving to the liquid an intense yellow color.

WATERS, METEORIC AND MAGMATIC.

Written for the MINING AND SCIENTIFIC PRESS
By JAMES F. KEMP.

In several relations of national importance the subject of water has in recent years assumed prominence. The reclamation of arid lands in the western portion of the country has led the Federal Government into enterprises of far-reaching consequence. Many officials are now engaged in recording and tabulating observations of the amount of rainfall and of the possibilities of storage in favorable localities. Even the divides of well-established lines of drainage are no longer safe from tunnels; and streams of no small size are either now flowing, or soon will be, regardless of geological or physiographical barriers. In the central portion of the country, the region of the great plains, artesian supplies have been especially sought and the drill has explored the depths, oftentimes yielding water, always adding to our stratigraphical knowledge. Underground reservoirs have furnished supplies in places far removed from the obvious catchment basin and the stream has been known to emerge under such head as to run a turbine upside-down. Our usual experience has been as much reversed as it was by Stockton in his droll story of 'Negative Gravity,' whose hero invented a machine that in adjustable degrees destroyed for its possessor the all-persuasive attraction of Mother Earth.

In the East the rapid growth of greatly concentrated population has made the questions of water supply of most insistent importance. As an example, New York City alone is busily and somewhat anxiously pushing the construction of a great aqueduct and reservoir, whose final cost will doubtless reach the estimates of $160,000,000. Every stream in this older settled part of the country has been gauged and its possible supplies have been measured and recorded in the same way in which we calculate our reserves of coal, iron ore, or other solid minerals. Water has become a great national asset. Nor can we eliminate it from the field of morals as we see the prohibition movement spreading from State to State. The water-wagon of the jester has become the band-wagon, if not the triumphal chariot, of the reformer.

In the discussions regarding the origin of ore deposits which have been vigorously and fruitfully maintained within recent years, underground waters have naturally been a leading topic. Views have undergone very interesting development and have at length attained the possibilities of quite definite statement. A condensed summary of past conceptions and of recent modifications may be of interest not alone to the general reader but also to those actively in touch with the phenomena of veins.

There are two kinds of underground waters with regard to origin and they are usually called in English the 'meteoric' and 'magmatic'. Abroad, the name 'juvenile', following the suggestion of Edouard Suess, the Vienna geologist, is sometimes used for 'magmatic' and we occasionally see the same application in English, but with us 'juvenile' is so firmly established in a different sense that it is very badly chosen and 'magmatic' is much to be preferred. Meteoric waters are derived from the rainfall, whereas magmatic waters are yielded by the molten igneous rocks when they reach resting places of diminished pressure and of crystallization and consolidation.

The rainfall has been recognized as the source of underground water from time immemorial. Wells, springs, artesian supplies, and the like were all naturally referred to it. As an obvious, world-wide, and constantly recurring source it had strong claims to confidence. Hence it is not surprising that in the discussions of ten years ago and earlier, the meteoric waters were practically the only ones considered. In 1883, Joseph Le Conte, whose memory geologists on the Atlantic coast cherish no less than do those on the Pacific, wrote an interesting and important paper on the 'Genesis of Metalliferous Veins',[1] in which the subterranean circulations are attributed to this source. In 1893 Franz Posepny contributed to the Transactions of the American Institute of Mining Engineers a more extended paper on 'The Genesis of Ore Deposits,'[2] in which any other source was hardly considered worthy of attention. L. De Launay, the distinguished professor in the higher School of Mines in Paris, in addition to many papers on ore deposits, in 1899 published a fairly large work entitled *Le Recherche, Captage et Aménagement des Sources Thermo-minérales* (Investigation, Confinement, and Utilization of Hot Springs), and the pages show little if any evidence that sources other than the meteoric were in the author's mind. Finally, in 1900, C. R. Van Hise, to whose tireless observation and broad philosophic grasp we, in America, owe so great a debt, most definitely summed up the matter of the underground waters in the paper on 'Some Principles Controlling the Deposition of Ores', before the American Institute of Mining Engineers. In this essay all waters, other than meteoric, are eliminated as of negligible importance and the ground-water of this origin is described as penetrating the earth to the limit of possible cavities. This paper marks the 'high water', perhaps one might say the 'deep water', limit of the meteoric ground-water, and since its publication, the tendency has been strong to see in the magmatic an agent of at least not inferior importance.

As regards the formation of orebodies by solutions from magmatic sources, the first of the important papers appears to be that of Elie de Beaumont, the distinguished French geologist, who shortly before 1850 published in the Bulletin of the Geological Society of France (2nd Series, Vol. IV, p. 1249), a paper in which he connected them with expiring volcanic phenomena. The views, although recently reviewed and elaborated, seem not to have attracted much support in the meantime. The use and development of the microscopic study of rocks about 1870 revealed the minute relationships of the constituent minerals of eruptive rocks and led to much reasoning regarding their order of formation, their collection together in large masses, and the consequent production of orebodies of magnetite, usually titaniferous. This is

[1] American Journal of Science, July, 1883, p. 1.
[2] Trans. Amer. Inst. Min. Eng. Vol. XXIII, p. 213.

especially true of the Swedish geologists of fifteen or twenty years ago and is shown in the writings of M. E. Wadsworth in this country, who was in this important branch of the subject distinctly a pioneer. These well-crystallized basic phases of eruptive rocks first gained general acceptance, but the production of orebodies by so-called 'solfataric' or 'fumarolic' processes were nevertheless not entirely overlooked. Baron von Richthofen appealed to them, when writing of the Comstock lode in 1865; and in a minor way, for easily volatilized ores, such as cinnabar and stibnite, they were doubtless in the minds of others, but they did not play a large part in the thinking of most students of the subject before the early nineties.

At this time the almost constant association of erruptive rocks with our Western ore deposits was more and more realized, because descriptions were becoming available and literature was accumulating. American geologists were facing actual facts and outgrowing earlier and often untenable views and prejudices.[3] Nevertheless, the general view was doubtless that the highly heated intrusive masses served especially to promote activity of circulation in the meteoric ground-waters and few credited them with contributing the waters themselves. The valuable German publication, the *Zeitschrift für praktische Geologie*, began in 1893, and in its second volume, 1894, we find J. H. L. Vogt developing the views on the emission of vapors, gases, and fluids which he described as 'pneumatolitic' and 'pneumatohydatogenic'. These were used in the interpretation of apatite deposits and tin ores, and aroused great interest. In 1895, J. E. Spurr's report on Mercur, Utah, appeared in Part II of the 16th Annual Report of the United States Geological Survey, and on page 449 we find the hot waters that produced the ore, referred especially to a source in an eruptive mass, believed to exist below. Meantime work was active along the gold belt of California and in successive papers we find the characters of auriferous veins and their wall-rocks more and more accurately established. In 1895, Waldemar Lindgren had come to favor a source in the deep-seated grano-diorite and carbonated thermal waters as the vehicle of introduction (Bulletin Geological Society America, VI, p. 240, 1895). It is not stated whether the thermal waters were regarded as coming from meteoric sources that had deeply circulated or as magmatic emisions, but the general disposition at the time was to look upon the former as the only kind of which we were assured and to think the latter of essentially speculative character. Even in the case of volcanoes, most people considered the steam as due to sea-water or rain-water, first absorbed and then emitted.

In the last five years of the closing decade of the past century, there are many indications of a growing belief that the very waters must themselves have come from the eruptives, and no attempt will here be made to trace them in detail. It is my desire to focus attention upon the significant and telling arguments rather than upon the somewhat vague speculation. There are such definite arguments and they are not always distinguished as clearly as they might be from speculative imaginings.

1. Volcanoes and all other eruptive outbreaks visible to us display vast quantities of steam, emitted in such a way as to leave no doubt of its derivation from the molten magma. The magmas certainly contain it and the more acidic ones owe their fluidity in no small degree to it. We find in the quickly chilled rocks or glasses, and especially in the pitchstones that it has been locked up in combination before it could escape. In the rocks formed of anhydrous silicates it has been evicted by the very processes of crystallization and the elimination of gases and vapors, to be subsequently condensed to liquids as a result inevitably attendant upon the solidification of almost all bodies of molten rock.

We may next raise the question whether it is conceivable that the molten rock, while deep within the earth, has been fed by sea-water or descending rain-water, and has absorbed its supplies in this way. Apparently it is impossible because cavities are believed to cease long before the deep seated reservoirs are reached, and because it is beyond belief that water could migrate up to and into a molten mass, rather than be driven outward by heat long before it came within touch of its goal. The water in the still molten eruptive rocks would appear to be an original and component part of the magma, as much as the silica and the bases. The only other possible and partial source would seem to be one suggested by R. A. Daly, and that is, the water combined in hydrated silicates, which constitute sediments and are absorbed by advancing eruptives.

2. An increasing number of deep shafts and boreholes are being sunk in regions that are obviously not areas of expiring but of still animate vulcanism. The latter condition prevails on the Comstock lode. In districts of the former class, except for an occasional slight dampness, whose origin is not necessarily meteoric, these excavations have shown that the ground-waters, chiefly referable to the rainfall, cease at a comparatively slight depth. In first bringing out this point in 1901, I roughly placed the extreme depth as 2000 ft. (Trans. Amer. Inst. Min. Eng. XXXI, p. 187, 1901). The contention has been supported by others since, notably T. A. Rickard[4] and J. W. Finch,[5] and recently in a very interesting way by M. W. Fuller, who, however, while citing with ease and consideration earlier writers who have been apparently wrong on this question, omits all mention of those who have apparently been right.

Mr. Fuller has had wide experience in the hydrographic branch of the United States Geological Survey and has estimated anew on the basis of additional data the actual ground-water in the rocks. It has been customary to express this as a sheet of water over the surface of the globe and of so many feet in depth. Delesse in 1861 gave it 7500 ft.; Slich-

[3] As an example, in the first edition of the 'Ore Deposits in the United States,' 1893, in the concluding remarks, great importance is attached to eruptive rocks. The significance of the statement lies in the fact that the author of the book had been trained under a greatly respected teacher, John S. Newberry, who often and emphatically argued that eruptives were characteristically barren and uninfluential.

[4] 'Ore Deposits, a Discussion,' p. 59, 1905.

[5] 'The Circulation of Underground Aqueous Solutions and the Deposition of Lode Ores.' Proc. Colo. Sci. Soc. Vol. VII, p. 193.

ter in 1902, 3000 to 3500 ft.; Van Hise in 1904, 226 ft.; Chamberlain and Salisbury, 1904, 800 to 1600 ft.; Fuller 1906, 96 ft.[6] Mr. Fuller's estimate distributed on the lower assumption of 5% cracks and other voids in rocks would give a limiting depth of about 2000 ft., and on the higher customary assumption of 10%, would give 1000 ft., either of which is a very interesting corroboration of the early suggestions from actual experience. Veins however in many cases go far lower than these moderate depths.

3. In 1902 the greatly respected Edouard Suess of Vienna delivered a striking address[7] to a convention of medical men gathered at the health resort of Karlsbad, Bohemia, a locality of hot springs, not less famous in America than in Europe, because, also, disordered livers are not limited to either side of the Atlantic. Professor Suess established the following points. The country rock at Karlsbad is granite, a potash-soda rock, while the springs are emphatically lime-bearing and show no connection with the formation from which they emerge. Apparently, they must come from some deep-seated source. Basalts appear to be the most probable mother-rock. For as long a period as chemical analyses have been available, the waters have shown no essential change in composition. They do not vary with the seasons, nor have they any apparent connection with the rainfall. Deep-seated magmatic sources are therefore favored.

A somewhat earlier paper by W. H. Weed[8] describes the Boulder hot springs, in Montana, but he attributes the water to meteoric sources set in active and heated circulation by an intrusive mass. No complete or perhaps very reliable analysis of the water is given, but a commercial one made for the proprietor of the neighboring hotel, contains soda, lime, and magnesia salts with no mention of potash. The country rock is granite with much orthoclase and it would be strange if the water should not show potash unless derived from some fairly deep-seated rock, low or lacking in this alkali. Professor Suess's line of attack might well be followed up in the case of hot springs elsewhere. The evidence of a capacity of a catchment basin and of the possible deep-seated intrusives is somewhat elusive and we cannot altogether avoid a step into the unknown, but the coincidences or the lack of them would be highly suggestive.

There have been other significant observations upon carbonated springs, notably a review of those in Europe by R. Delkeskamp,[9] with the conclusion that the carbonic acid is derived from eruptive rocks. Even at Saratoga, New York, a recent State investigation in connection with the artificial tapping of the waters so as to utilize the gas, has led to the conclusion that some deep-seated and not fully dead eruptive is the most likely source of at least the carbonic acid.

4. The contact zones formed where intrusive rocks act upon limestones seem to demand emissions both of solvents and of dissolved materials, especially iron and silica, in order to explain their actual chemical composition. The points for and against this explanation have been recently set forth in the columns of the MINING AND SCIENTIFIC PRESS[10] and in other places. In the recent monographs of the United States Geological Survey on the Arizona copper districts (except Globe), they are extensively described, but the paper of Lindgren on Morenci has the closest bearing on this subject.[11]

If the general circulation of the meteoric waters is limited to the depths earlier set forth, then it is difficult, even granting that they circulate freely, to establish those contrasts between places of solution and places of precipitation which would be required for the production of veins or other orebodies. The differences of temperature between surface and extreme depth is slight, something like 25°F, perhaps, but the pressure does mount up at approximately one pound per inch, static, for each two feet of water-column. In general, when reasoning about eruptive rocks and their phenomena of crystallization, resorption, and so forth, we usually think of heat and pressure as antagonistic, the former promoting solution and retarding crystallization. While this antagonistic relation may not so fully and may not at all apply to the aqueous solutions within 2000 ft. of the surface, yet it is significant that once we pass the zone of weathering, according to Van Hise, we enter more and more the zone of cementation, essentially one of precipitation. Our orebodies in the latter seem, with a preponderance of probability, if nourished by descending meteoric waters, to have derived their supplies from the limited area of weathered rocks immediately overhead. In speaking of this subject, one cannot help having in mind the lead and zinc deposits of the Mississippi Valley and all that has been written upon them. Even here we may query whether zinc as a matter of observation in its downward journey does not chiefly precipitate as the 'dry-bone' ores at or near the water-level, being thus halted in its course; and whether, even granting its limited subterranean journey, it will be thrown down on emerging unless there should be an intermingling of some positive precipitant such as bitumen or sulphuretted hydrogen, which must be considered a factor no less essential than the area of brecciation itself. Contrasted conditions of some sort are prime necessaries and it would seem as if they had been sometimes rather lightly passed over.

While in the foregoing paragraphs the full depth of 2000 ft. for the general ground-water has been used, yet some have thought with reason that only a part of this is really in motion. Posepny speaks of the deeper portions which are relatively still and which move with great slowness. Finch considers in the 1000 or 1500 ft., which he assigns to the meteoric ground-waters, that the largest and lowest part is practically motionless, unless disturbed by a great fault or an igneous intrusion. Then in the former case for a brief period the water descends, circulates rapidly, and soon heals the wounds with a vein; in the latter case it could only operate above or in the neighborhood of the intrusive. Of course circulation

[6] Water Supply and Irrigation Papers, No. 160, pp. 61, 62, 72.
[7] A translation by D. H. Newland will be found in the *Eng. & Min. Jour.* July 4, 1903, p. 8.
[8] U. S. G. S. 21st Annual Report, Vol. II, p. 227, 1900.
[9] 'Vadose und juvenile Kohlensäure,' *Zeitschr. für prak. Geol.* Feb. 1908, p. 33.
[10] March 24, 1906.
[11] Professional Paper No. 43, U. S. G. S.; Trans. Amer. Inst. Min. Eng. Vol. XXXV, p. 511.

along or near a fault does not affect, for the acquisition by leaching, a very wide area of subsequently precipitated vein-matter, since if the deeper-seated rocks are tight enough to prevent the ordinary ground-waters reaching them, they would not be widely opened to their passage even by a very great fault.

These considerations are somewhat difficult of sharp mathematical statement and their general bearing and influence are the chief things to weigh. But if we admit the force of the claim that contrasted conditions are essential for solution and precipitation; and if, for cases of orebodies in regions where eruptive rocks as factors cannot be or need not be eliminated, we seek the agent that most efficiently affords them both, then magmatic waters must make a strong appeal.

In preparing the paragraphs above, it has not been the intention or expectation to present anything essentially new, but rather to bring together matter which, for many readers, may be too scattered to be grasped at its full import or even to be known. There has been, also, no desire to over-emphasize the magmatic waters, although their discussion occupies more space, but they are not such well known or easily understood phenomena as the meteoric, and the points regarding them are not so generally a part of every man's fund of information. We seem more and more and somewhat irresistibly tending to believe that at least our Western veins have been deposited in a geologically brief space of time, by waters whose active circulation followed hard upon some igneous intrusion. With much reason we may conclude, following the significant and recently made suggestion of George J. Bancroft,[12] that the waters had access to some new up-welling from the deeper portions of the globe exceptionally rich in the metals. We may think of internal reservoirs of meteoric waters at comparatively small depth invaded and set in motion by the eruptive rock which is leached by them in its cooler stages, or we may imagine magmatic reservoirs emptied by eviction from the molten mass as it solidifies and carrying out the metals in the gangue in solution.

To the ordinary, cold, descending rain-waters we find it difficult to ascribe much effective dissolving action, except in the zone long known to miners as the zone of oxidation, and often now denominated by Van Hise's term as the zone of weathering.

Municipal ownership of coal mines has been discussed for some months by the city council of Vienna, Austria, and it is reported that the city is now trying to secure control of mines in Moravia. The reasons given for the purchase are the high price of coal, and the difficulty of securing a steady supply for the municipal gas and electric plants.

Copper manufacturers are at present working at about half plant-capacity in this country. A slight increase in the domestic demand has taken place, and considerable copper has been purchased abroad for speculative purposes.

[12] 'The Formation and Enrichment of Ore-bearing Veins,' Bi-Monthly Bull. Amer. Inst. Min. Eng., May 1907, p. 499, and especially 503 and 513.

Decisions Relating to Mining.

Specially reported for the MINING AND SCIENTIFIC PRESS.

LOCATION OF CLAIM—FAILURE TO MARK BOUNDARIES AND PERFORM WORK.

When a mining claim is properly located by posting the required notice and marking the boundaries within the statutory period, the right to the claim relates back to the time of the posting of the notice and segregates the land from the public domain, and a subsequent location cannot be made until there has been a failure to perform the statutory work within ninety days from the posting of the notice; but where notices were posted and the claims were not staked within ninety days thereafter, the location was not complete, and the claim was not segregated from the public domain, though the posting of notice carried with it the right to define the boundaries within the ninety days.

Nash *v.* McNamara, (Nev.) 93 Pac. 405, Jan., '08.

LOCATION OF CLAIM—RIGHT OF POSSESSION.

The owner of a valid lode location has the exclusive right of possession and enjoyment of all the surface included within the lines of the location, and this right of possession forbids any trespass. Without the owner's consent or acquiescence, no one can rightfully enter upon the premises, or disturb its surface by sinking shafts or otherwise. It was the intention of Congress to secure the fullest working of the mines and the complete development of the mineral lands, and for this purpose the owner should have the undisturbed possession of not less than a specified amount of surface; and the exclusive right of such possession is as much the property of the locator as the vein or lode by him discovered and located.

Nash *v.* McNamara, (Nev.) 93 Pac. 405, Jan., '08.

DEATH OF MINER—CONTRIBUTORY NEGLIGENCE.

A foreman in a mine, killed by rock falling from the roof of a tunnel, which the mining company negligently failed to protect, was guilty of such contributory negligence as to bar a recovery, where it appeared that he was an experienced miner and knew that the roof was dangerous, and had not been assured that the place was safe or would be made so, although he was not charged with the duty of inspection, had no authority to supply material necessary to make the place safe, was not bound to use even ordinary care to discover the dangerous condition of the roof, and his superior directed him to work where he did.

Tanner *v.* Wickliffe Coal Co., (Ky.) 108 Southwest. 351, March, '08.

COAL-LAND ENTRY—VIOLATION OF DEPARTMENT REGULATIONS.

The violation of regulations for entering coal-lands cannot be made the subject of a criminal prosecution in the absence of a statute distinctly declaring such violation to be a criminal offense.

United States *v.* Keitel, 157 Fed. 396, Dec., '07.

DEATH OF MINER—PROOF OF PREVIOUS ACCIDENTS.

In an action for damages for the death of a miner killed by falling rock in the man-way of a mine, it was held proper to prove previous accidents occurring shortly before the one in question, for the purpose of showing that the owner of the mine knew that the existing conditions in such man-way were dangerous.

Hotchkiss Mt. & Reduction Co. *v.* Bruner, (Colo.) 94 Pac. 33, March, '08.

CONSTRUCTION OF LEASE.

The provisions of a coal lease as to the payment of royalties were susceptible of two constructions. After receiving the payment of royalties for several years, the lessor could not claim royalties on a different theory.

McKeever *v.* Westmoreland Coal Co., (Pa.) 68 Atlant. 670, Jan., '08.

WATER SUPPLY FOR KALGOORLIE.

Written for the MINING AND SCIENTIFIC PRESS
By M. W. VON BERNEWITZ.

For the purpose of rainfall comparison the State of Western Australia may be divided into four sections, namely, the tropical northwest, with an average rainfall of 24 in.; the middle and southwest coastal districts, with about 33 in.; the eastern and northern goldfields, with 9 in.; and the desert, which comprises about half the area of the State (975,920 square miles), the rainfall over which is unknown.

The East Coolgardie goldfield, of which Kalgoorlie is the great centre, is in the third section, and the following notes refer to its present water supply. During the summers of 1893-94, shortly after this field came into notice, there was a water famine due to the scanty rainfall, and the great rush of those whom the wealth of the country attracted. Water, condensed from steam and still warm, was sold at 60c. per gallon for drinking purposes, and, quoting the words of the Minister for Works in 1902, "I am told—it is hearsay, of course—that hotel-keepers were wont to more jealously guard the manner in which the customer helped himself to water, than to the whiskey bottle; and in regard to water for bathing purposes, out of respect to the feelings of many prominent citizens, I will draw a veil."

There always was a fair amount of salt water available for mining purposes, but for boilers and domestic use it had to be condensed, and for milling it was not satisfactory at all. As mining operations extended and the population grew on the Coolgardie and Kalgoorlie field (population of the latter now being 29,000), the water question became serious.

Many schemes were proposed, some for pumping fresh water from rivers near Perth, salt water from the sea on the south coast (200 miles), condensing the local salt water on a large scale, and building big storage dams on the fields. They all fell through. Definite steps were taken in 1895, when C. Y. O'Connor, then Government Engineer-in-Chief, reported to Sir John Forrest, then Premier of the State, on a scheme for damming up one of the valleys in the Darling ranges, about 30 miles from Perth. Seventeen valleys were examined, and that of the Helena river, at Mundaring, was decided upon as the most suitable for a reservoir. This is now known as the Mundaring reservoir. Toward the end of 1896 a bill passed Parliament, after much opposition, for raising a loan of $12,500,000 for the construction of the waterworks. Up to date the scheme has cost $15,700,000. The reservoir has a catchment area of 570 square miles, with an average rainfall of 33 in. per annum. It holds, when full, 4,680,000,000 gal., and the water is dammed back some 8 miles. The weir is 725 ft. long at the top, 100 ft. high, 85 ft. thick at the bottom, with uniformly decreasing thickness to the top, where it is 8 ft. The upper side or face of the wall is vertical, the whole being of concrete. The illustration shows the arrangement at the top for the flood-waters, the valve-tower, and the off-take and scouring-pipes at the bottom.

The Mundaring Reservoir, Western Australia.

In putting in the foundations a fissure, due to an intrusion of diorite through the granite of the river bed, caused much extra expense to make a good job. The reservoir has filled every season since 1903; and in 1907 it is estimated that 15,000,000,000 gal. ran to waste. Steps are now being taken to connect up with the mains of Perth and its suburbs, having a population of 50,000. The total cost of the reservoir, including a 4-mile railroad with a 4% grade, was $1,240,000.

The pipes are 30-in. diam by 28 ft. long, consisting of steel $\frac{1}{4}$ and $\frac{5}{16}$ in. thick. There are 66,600 joints of the pipe, making in all 353 miles. The pipe was made locally on the Mephan-Ferguson patent locking-bar system. The joint rings are of the sleeve pattern, run up with lead, and caulked with a patent caulking machine. Including valves, specials, trenching, etc., the pipes cost $8,900,000. The pumps are horizontal, high-duty, duplex, direct-acting, 6-cylinder, triple-expansion, Worthington engines, with pump plungers externally and centrally packed, and the engines furnished with surface condensers and air-pumps. There are 12 pumping stations, with a

total of 20 engines and 20 Babcock & Wilcox boilers, the latter fitted with superheaters, feed-water heaters, and economizers. Two men only are required per shift at each station. The steam cylinders are 16, 25, and 46 in., with a 36-in. stroke; and 12 of the pumps have double-acting plungers of 15 in. diam., the remaining eight have plungers 21 in. diam. The steam valves are of the Corliss type. Each duplex engine takes 300 hp., with steam at 175-lb. pressure. The bottom of the reservoir is 340 ft., and the distributing reservoir at Kalgoorlie is 1375 ft. above sea-level. The capacity of the pumps is 5,600,000 gal. per day. Actual pumping costs are 20c. per 1000 gal. The pumps, boilers, buildings, sidings, etc., cost $2,149,000.

ANALYSIS OF THE WATER.

Silica	0.26	gr.	per	gallon
Iron and alumina	0.34	"	"	"
Carbonate of lime	1.62	"	"	"
Sulphate of lime	0.70	"	"	"
Carbonate of magnesium	0.99	"	"	"
Chloride of magnesium	2.72	"	"	"
Sodium chloride	17.47	"	"	"
Undetermined	0.14	"	"	"
	24.24	"	"	"
Solids in suspension	17.00	"	"	"
Total solids	41.24	"	"	"

During the last fiscal year of the work the total water consumption amounted to 688,548,000 gal., which was sold at prices from 24c. to $2.40 per 1000 gal. The Kalgoorlie group of mines now takes 1,000,000 gal. daily. Leakage and evaporation from the reservoir, service reservoirs, and main pipes is estimated at 140,000 gal. daily.

The cost of the installation was $15,700,000, and the operating expenses are $325,000 per year, while the revenue in 1906-07 amounted to $835,000. This, of course, is insufficient to meet interest account and provide a sinking fund, so that the estimated deficit is $420,000 for the year, but the benefit to the mines and the community has been almost incalculable.

Two Years' Fire in a Mine.—A report from Broken Hill states that a little inconvenience is being experienced on the Proprietary mine in connection with the Block 12 fire, which has been burning nearly two years. The fire has extended right up to the water curtain, on the north side, and the smoke and gas are passing through the water into the workings. Several men have lately been affected by the gas. There is no reason to suppose that the fire will extend beyond the water curtain, though the extension of the fire is causing anxiety. When this fire broke out it was the third occasion on which the mine had been on fire. On Sunday night, July 25, 1895, an outbreak was discovered. The second outbreak occurred on Sunday morning, September 12, 1897. It is not known how long this burned, for it was in a portion of the mine which was worked out, and the locality had been completely blocked up. The fire now burning began on a Saturday night in February, 1906. It was attributed by the general manager to a blast which had been fired and carelessly left, because it was 'crib' time. When the men returned the gallery was full of smoke, so that it was impossible to turn on the water, of which there was an abundant supply close at hand, and an effort was made to drown the fire from the 300-ft. level, and to smother it by blocking out the draft. It has steadily crept along as far as the water curtain on the north side.—*Queensland Mining Journal.*

Artesian Basins.—The presence of artesian conditions in an area is frequently inferred by geologists from a study of rock structure. In what is properly termed an artesian basin the layers of rock are bent downward, so as to resemble a pile of shallow plate-shaped dishes placed one within another. One or more of the beds of rock is porous and allows water supplied by rain on its upturned edges to percolate into it. Above and below the water-charged layers are close-textured rocks, like clay, that prevent the escape of the water in the bed between them. A number of such structural basins are found in the region studied by I. C. Russell of the U. S. Geological Survey. Confirmation of the supposition that water under pressure exists beneath the surface in any area is found at many places in the occurrence of warm springs—those with temperatures ranging from 60 to 100°F. As the water in artesian basins has descended from the surface, and as the temperature of the earth increases with depth, the deeper the water has penetrated into the rocks the higher will be its temperature. The increase in the temperature of the earth below a depth of about 50 ft. in temperate regions is in general about 1°F for each 60 ft., but there is considerable evidence favoring the conclusion that in southern Idaho and adjacent parts of Oregon the rate of increase is approximately 1°F for each 45 ft. in depth. At the depth of 50 ft. the temperature corresponds to the mean annual temperature of the locality chosen, which in this region is approximately 50°F, so that if a spring in this region has a temperature of 65°F. or 15° above the temperature of the stratum of no seasonal variation, it would be safe to conclude that the water rises from a depth of at least 675 ft. below that stratum, or 725 ft. below the surface. Such a spring would therefore serve as an indication of the depth to which a well should be bored to penetrate the water-charged rock layer. Mr. Russell calls attention to the fact that while warm springs may indicate the presence of a water-charged layer that would supply flowing wells, a hot spring, or one having a temperature of more than 100°, is not so favorable an indication. Hot springs ordinarily rise from depths so great that even if they come from a well defined water-charged layer it would be unavailable as a source of supply for most purposes for which artesian water is used, as the expense of drilling to reach it would be unjustifiable.

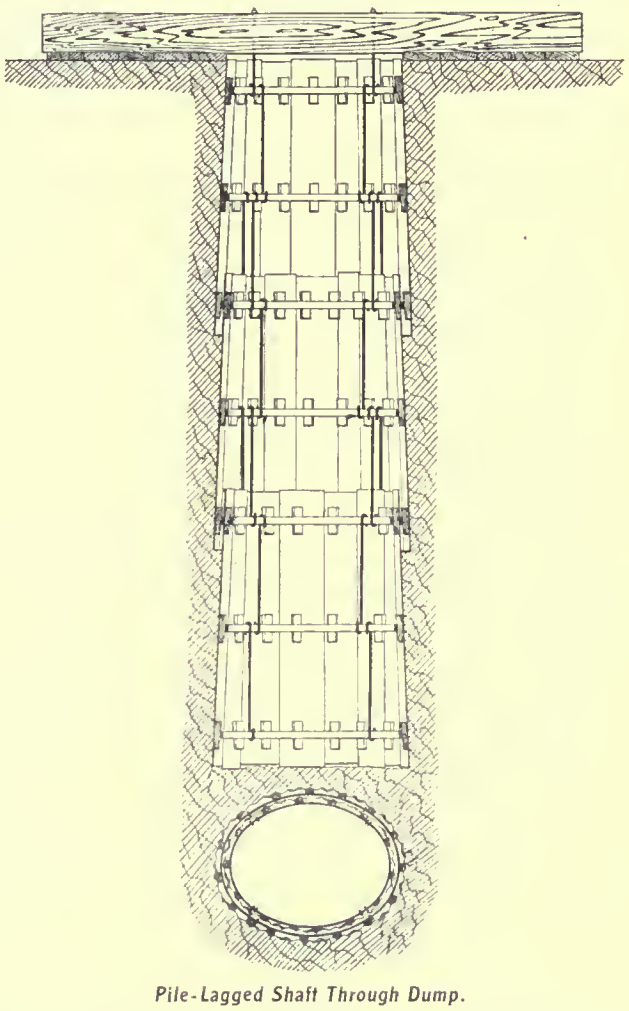
The Director of the United States Mint estimates that the world's consumption of the precious metals in the arts alone, that is, for manufacture of jewelry of all kinds, gold filling for teeth, gold leaf for gilding, etc., was 5,882,000 oz. of fine gold, valued at $121,500,000, and 85,196,000 oz. silver, valued at $57,500,000. These figures represent absorption of these metals into the arts for the single year 1907.

SAMPLING OF MINE DUMPS.

By Henry S. Munroe.

*The sampling of waste dumps presents a difficult problem. Portions of the dump result from periods of development work in barren rock, while other portions, representing the growth during periods of wasteful or careless management, may be very rich. If the dumps are formed in the ordinary way, by dumping cars at the top of the bank, the stratification and therefore the zones of rich and poor material will be in inclined layers. Moreover, as the cars are dumped at the top, the larger pieces tend to roll to the bottom of the slope, while the fine stuff lodges and remains near the top. The upper portion of the dump contains most of the fine material, and is therefore likely to be rich; and the bottom, consisting of lumps and coarse material, is in general poorer than the average. The usual method of sampling a dump is to take numerous small samples from the sides and top, which are either assayed separately or combined. If this method is adopted, the points to be sampled should be determined by measurement on contour lines at regular intervals, and at the corner of 25-ft. squares on the top. In any case, due weight should be given to the tonnage represented by each sample. In dump sampling, a small crushing plant is essential, owing to the large size of samples required. In most cases, a careful sampling is necessary, and such expense is inevitable.

The following is a method of sampling adopted in Bolivia in sampling large dumps in a district where timber was expensive and corrugated iron could be obtained at a reasonable cost. In order to avoid the sources of error incident to sampling in the ordinary way, and to reach the deeply buried portion of the dumps, which were believed to be rich, it was decided to attempt the sinking of vertical shafts through the dumps to obtain the desired samples. The advantages of this method of dump-sampling are obvious. Each shaft traverses numerous inclined layers, and gives information as to the contour of the ground which is required in making the estimate of tonnage. Small elliptic shafts were sunk, but owing to the loose dry character of the ore, it was necessary to drive some form of spiling every few inches. Plank and timber being expensive, it was decided to use light iron rings backed by sheets of corrugated iron, a material which is commonly used in South America for building purposes. This was cut into pieces of suitable size, and made excellent poling boards, light and stiff and occupying little space in the shaft. By reason of its smooth surface, the iron sheets drive easily, with but little friction, requiring light blows only of a 3-lb. hammer. After experimenting with sheets of different sizes it was found that the best results were obtained with pieces about five feet long and a foot or less in width. To support this corrugated iron lining, elliptical rings of ⅜ by 1½-in. bar iron were used, the ends being welded together. The rings were made of elliptical rather than circular form, to permit the large bottom rings of each set to be passed through the smaller upper rings. Also the elliptical form, for equal areas, gave the workmen more room for pick work and shoveling. These rings were supported by hooks of ⅜-in. rod. After experimenting with rings of different sizes, the dimensions indicated below were adopted, the middle ring being 32 by 38 in. and the upper and lower ring respectively 2 in. smaller and larger each way. A shaft of these dimensions can be sunk rapidly and gives a sample of manageable size. With small men it proved practicable to use rings of less dimension than this. In one case a shaft was sunk successfully to a depth of 22 ft. with rings averaging 22 by 28 in. In all, nine shafts were sunk in eight weeks time, the deepest being about 60 ft. This system of shaft-lining, though composed



Pile-Lagged Shaft Through Dump.

of light material, possesses considerable strength and stiffness. The over-lapping of the corrugated sheets and the double rings, tightly wedged together where the sections join, add much to the strength of the lining. The hooks are elements of weakness, as these will straighten out at about one-fifth of the ultimate breaking strength of the rods. The strength of these hooks may be increased by always inserting the point of the upper hook in the space between the ring and the corrugated iron sheets, and by fastening the point of the lower hook to the rod with a slip ring. The work of shaft-sinking will be facilitated by having on hand extra hooks, shorter and longer than the standard length. It will be well also to have a number of hooks with turn-buckles, to replace hooks that may be broken elsewhere than at the bottom of the shaft.

* Abstracted from School of Mines Quarterly, Columbia University.

RECENT CYANIDE MILL IN MEXICO.

The cyanide plant of the Guanajuato Reduction & Mines Co., started with 80 stamps, milling 250 tons per day, being the first unit of a proposed 1000-ton mill, the second unit of which was put in operation in August 1907. The ore is first crushed through a No. 5 Gates crusher, passes to a sorting-belt, and thence to a trommel with 1⅛-in. apertures. The oversize is crushed in a No. 4 D Gates crusher. The mill construction is of steel throughout, the batteries set back to back, 80 on each side. These stamps are all of 1050-lb. weight, making one hundred 8-in. drops per minute. The mortars are set directly upon concrete foundations without anvil block. The stamps are driven in batteries of 40 to a shaft, one 100-hp. motor driving each 40 stamps. The ore is crushed in 0.04% KCy solution through 26-mesh 28-gauge steel-wire screens, and is classified by spitzkasten into two bottom products and an overflow. The coarse product from the first spitzkasten is concentrated over No. 4 Wilfley tables, practically the entire tailing from which is re-ground in tube-mills. The fine spitzkasten-product is concentrated on No. 4 Wilfleys, the tailing going directly to the cyanide plant. The overflows from the spitzkasten are all elevated to large thickening cones, the bottom product being concentrated on Risdon-Johnston tables, as is also the tube-mill product. There are 24 Wilfley tables, 18 Risdon-Johnston concentrators, and one Overstrom in the mill. Two Abbé tube-mills, 4 ft. 6 in. by 20 ft., do the re-grinding, using silex lining and No. 4 Danish pebbles. The average life of the linings has been eight months.

The mechanical efficiency of the mill is well demonstrated by the fact that during the first year of operation the total loss of possible stamp-hours amounted to only 0.87%, this including all renewals of shoes and dies, screens, belts, etc. The total tailing passes through a tunnel and sampler to 6 thickening cones 20 ft. diam. with 45° sides, the clear overflow being pumped back to the mill-supply tank 22 ft. diam. by 20 ft. high. The thickened product, carrying about four tons of solution to one of pulp, is then introduced into a cast-iron pipe with bell-and-spigot joint, 8 in. diam., ⅝ in. thick, and 5440 ft. long, which conducts it to the cyanide plant a mile away. This line is laid on a uniform grade of 2¼% for its entire length, except for the 800 ft. at the head of the line, which has a grade of 3½%. No difficulty whatever has been experienced in the conveyance of pulp through this line at the thickness mentioned, and after having conveyed 150,000 tons of ore there are no appreciable signs of wear in the pipe.

At the cyanide plant, classification into sand and slime is effected by four 8-ft. cones without ascending current, and the bottom product is again put through sixteen 4-ft. cones with ascending current, the overflow from all cones going direct to the slime-plant. The bottom product of the 4-ft. cones goes through Butters distributors to one of three receiving tanks 48 in. diam. and 8 ft. high, with filter-bottom. These are filled in rotation, drained and discharged through bottom-discharge gates to a conveyor belt system which passes over the centres of 15 leaching vats each 40 ft. diam. by 8 ft. high. After treatment the sands are sluiced into the river; 15-day treatment is given, involving 30 baths of 0.5% and 6 baths of weak stock-solution. The slime is treated by decantation, the residues being passed through a Butters filter. All decanted solutions pass through the zinc-room before returning to the stamp-mill. The Butters filter contains 75 leaves, and handles 220 tons of dry slime per day.

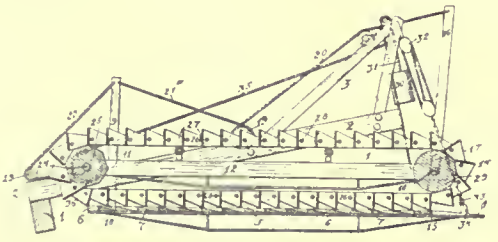
Battery chips may be conveniently assayed by removal of the iron as matte and the concentration of the gold in a lead button. With careful manipulation, the gold in the matte may be reduced to a negligible quantity. The chips usually consist of pieces of iron from the size of a pin head to as much as half an inch in diameter. The scorification assay is useless, owing to the small quantity that can be treated. The solution of the iron by acids is slow and expensive. The best method is to assay 1 A.T. of chips by passing the iron into a matte free from gold, and collecting the gold in a lead button. A charge with 50% of sulphur to the chips taken, yields a perfectly malleable lead button, and a matte carrying practically all the iron originally in the charge. As in the assay of copper ore, care has to be taken that no excess of litharge is left in the slag, as any excess of sulphur would yield an exceedingly large button. An iron nail should be used in all cases, to keep the button malleable and the matte free from lead. The following charge yields excellent results with battery chips: chips, 1 A.T.; soda, 1.5 A.T.; fused borax, 1.5 A.T.; sulphur, 0.5 A.T.; silica, 0.5 A.T.; charcoal, 1 gram; and an iron nail. Silica is added to protect the crucible, and an excess of flux is used. After a quick fusion the charge is given a wash-down with a small quantity of litharge and charcoal. In this assay, the furnace used for fusion must run at a slightly higher temperature than is usual for a gold assay, and the crucible must be allowed to remain in the furnace for 20 min. after quiet fusion. If the heat be insufficient or the charge be poured too soon, the iron will be found in small lumps on the top of the lead button, and not completely absorbed into the matte. Generally the battery chips assay less than 6 oz. per ton, and the amount of gold in the matte is not weighable. In cases where the estimation of silver is required, it is necessary to save the matte and recover the silver by scorification. The sampling of battery screens often presents difficulties, but this may be overcome by giving a weighed quantity of battery screens an oxidizing roast, after which it can be pulverized easily and assayed by the same method as battery chips.—Leslie J. Wilmot.

The tower of the Metropolitan Life building, now in process of construction at Madison Square, in New York City, and which is already the highest building in the world next to the Eiffel Tower, at Paris, is to have 37 ft. added to its height, thus bringing the total number of stories, including two in the basement, up to 50, and the top of the surmounting glass ball 693 ft. above the sidewalk level.

MINING AND METALLURGICAL PATENTS.

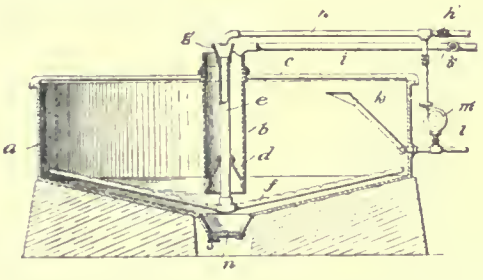
Specially Reported for the MINING AND SCIENTIFIC PRESS.

MINING-DREDGE.—No. 886,728. Thomas P. Rochford, Valdez, Alaska.



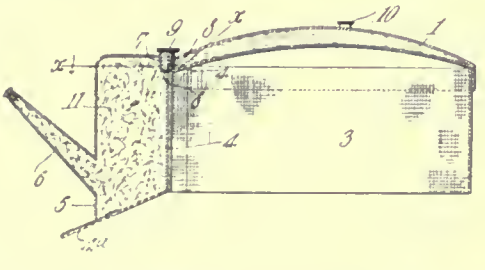
In a mining-dredge, the combination of an inclined sluice-box provided with an open top, gold-collecting riffles upon the bottom of the box, a digging shovel at the front end of the box, means for supporting the box with its front end submerged in a body of water, means for oscillating the box longitudinally to cause its shovel to loosen the gravel, and an endless rotary elevator arranged in the top of the box for elevating the gravel loosened by the shovel.

SLIMES TREATMENT.—No. 886,900. Charles E. D. Usher, Johannesburg, Transvaal.



The hereindescribed process of treating metalliferous slime which consists in maintaining said slime in a state of suspension by the upward passage therethrough of a solvent or wash liquid, at such a rate as not to materially disturb the homogeneity of the slime and collecting the clear liquid above the slime.

MINER'S LAMP.—No. 886,441. Samuel J. Thompson, Bluefield, West Virginia.

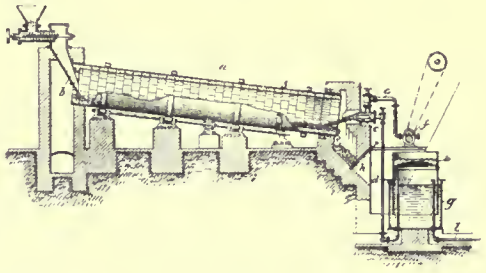


A cap having a front guard-plate, a vizor extending therefrom, a receiver, said vizor and guard-plate constituting the bottom and rear wall respectively of the receiver, a concavo-convex reservoir extending from the upper portion of the guard-plate and opening into the receiver, means for controlling the passage of oil from the reservoir to the receiver, a plate-holder extending from the receiver, and a flexible band secured to the guard-plate and to the edge portions of the reservoir, said reservoir constituting the crown of the cap.

PROCESS FOR EXTRACTING METALS.—No. 886,866. Dennis R. Robertson, Denver, Colorado.

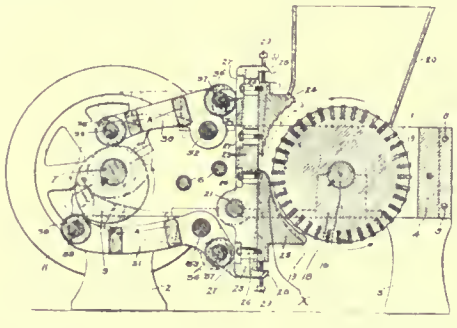
The herein described process of extracting gold, or gold and copper, from ores containing the same, which consists in adding to the partially pulverized crude ore aqua regia, agitating and applying steam to the mass until it is brought to the boiling point, and adding 20% of cold water, filtering, and adding iron to the filtrate, while retaining the mixture at approximately 70 degrees.

PROCESS FOR THE BALLING TOGETHER OF PULVERULENT OR DUSTY ORES.—No. 886,683. Hugo Dicke, Frankfort-on-the-Main, Germany.



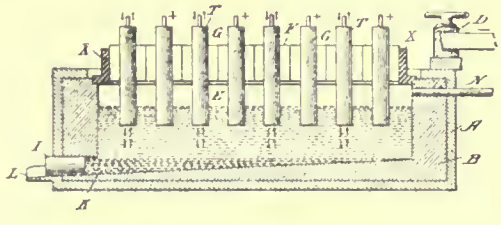
The method of balling together or nodulizing of dusty pulverulent ores or ores of small size of grain, with, if desired, simultaneous oxidation or reduction in the rotary furnace, which consists in subjecting the ores to a heat of at least 1000 degrees, by a pointed flame whose shape may be adjusted and having an oxidizing capacity in the zone of the furnace which is limited by said flame.

ORE-CRUSHER.—No. 887,003. Charles O. Michaelsen, Omaha, Nebraska.



In an ore-crusher, a roller having a plurality of longitudinally extending bars of hard material set in the peripheral surface thereof, a rocking-lever pivoted adjacent said roller, jaw-blocks of hard material secured to said rocking-lever adjacent opposite ends thereof, the faces of said blocks working adjacent and co-operating with the roller to crush materials between the same, means for adjusting the positions of said jaw-blocks longitudinally of the rocking-lever, a cam, cam-levers actuatable thereby, said cam-levers engaging the rocking-lever to actuate the same, and means for simultaneously actuating the cam and the roller.

ART OF REDUCING ALUMINUM AND OTHER METALS.—No. 886,757. Henry S. Blackmore, Mount Vernon, New York.



The process of reducing metal from substances containing the same, which consists in fusing the metal-containing substance by passing a non-metal-yielding current through the fused material between contacts, and liberating the metal from its compound by the action of a metal-yielding current passed therethrough in a path disposed parallel to or with the path of the heating or non-metal-yielding current.

ELECTROLYTIC PROCESS OF PRODUCING METALS.—No. 886,857. Edgar F. Price and William S. Horry, Niagara Falls, New York.

The process of producing alkali or alkaline-earth metals, which consists in electrolyzing a molten salt of the desired metal with an anode essentially comprising a carbide of that metal.

MINE REPORTS.

NORTH STAR MINES, NEVADA COUNTY, CALIFORNIA.

During the year ending December 31, 1907, the North Star mines produced a total value of $937,816, at a cost for current operation of $398,935 and for development of $93,020, or a total outlay for operating and development of $491,955, leaving an available profit of $445,860. Outlays during the year for improvements, $42,195, and property purchase, $344, amounted to $42,539, leaving a balance of $403,320. Interest earned during 1907 amounted to $22,760, increasing the total net earnings from all sources for the year to the sum of $426,081. Out of this were paid dividends amounting to $250,000, 10% on the capital stock, leaving a surplus of $176,081 to be added to the company's available cash resources, amounting, at the end of 1907, to about 30% of the total issued capital.

The above sum was produced wholly from the North Star mine, from 78,366 tons of ore milled, being an average yield of $11.967 per ton, at an average cost of $5.091 for current operation and $1.187 for development, aggregating $6.278 and leaving a realized profit of $5.689 per ton over all costs of operation and development. Outlays during the year for improvements and property-purchase amount to $0.543, leaving a net mining profit, over all outlays, in cash surplus, of $5.146 per ton of ore.

The ore produced was about 6300 tons less than in 1906, by reason of a labor strike, which interrupted productive operations during January and February, 1907. Fortunately the improved quality of the ore more than compensated for the lack in quantity, so that the value of the output for 1907 considerably exceeded that of any previous year. Of the above stated total tonnage, the old or upper workings of the North Star mine, on and above the 2700-ft. level, operated through the incline shaft, produced 21,211 tons, yielding $296,798, or an average of $13.993 per ton, at an operating cost of $129,037, or $6.084 per ton, and a resulting profit of $167,761, or $7.909 per ton. The outlays for development and exploration in the old or upper mine, during 1907, amounted to $35,724, or $1.684 per ton, giving a total cost of $164,762, or $7.768 per ton, and a net mining profit of $132,036, or $6.225 per ton of ore. During 1907 the deep or lower North Star mine, comprising all workings below the 2700-ft. level and operated through the Central vertical shaft, produced 57,155 tons of ore, yielding $641,018, an average of $11.215 per ton, at an operating cost of $269,898, or $4.722 per ton, and a resulting profit of $371,120, or $6.493 per ton. Additional outlays for development and prospecting work in the lower mine, during 1907, amounted to $57,295, or $1.002 per ton, making for operation and development together a cost of $5.724, and leaving a net mining profit of $313,824, or $5.491 per ton of ore.

These actual operations of last year fully realize the favorable indications of previous reports and warrant the reasonable expectation that, under present conditions of operating capacity and the now visible or probable ore supply, the mine may continue to produce similar results during many years to come. The results of development and prospecting work during 1907 have been satisfactory, both in the upper and the deeper levels of the mine. At the close of 1906, as stated in the report for that year, the visible ore resources in the old upper mine were very small and unpromising, but the persistent extension of prospecting drifts fortunately disclosed good ore on various levels, resulting in profitable operations for 1907, as shown in the figures herewith submitted. In the deeper levels, now the main sources of production, the stopes have continued steadily to yield a full supply and a somewhat better quality of ore than in the two preceding years. The developments in the extreme bottom of the mine are especially satisfactory. Drifts have been extended in both directions on the 4400 and 4700-ft. levels with encouraging results. The sinking of the incline shaft, following the vein downward from the 4000-ft. level, at the bottom of the Central vertical shaft, was resumed October 1, at the point where previous sinking had ceased, somewhere below the 4700-ft. level, and at the end of 1907 this work had reached a depth of 5000 ft. from the outcrop, measured on the dip of the vein, or 2000 ft. vertically below the overlying surface. In this work the shaft was sunk in ore for 150 ft. of its course, disclosing a vein from 3 to 6 ft. thick, of rich quartz, which now promises to be the source of much profit.

It may be noted here that the North Star mine, in its career of nearly 50 years has been more or less continuously ore-bearing from the surface to the present bottom, nearly a mile deep on the dip of the vein, and that at the present time the current production of ore is contributed from practically all the different levels opened in the mine at depths varying from about 1500 to 5000 ft. below the outcrop.

The outlays for improvements during 1907, amounting to $42,195, were made mainly for equipment account, partly for the completion of the cyanide plant at the old North Star mill and partly for electric and air-compressing machinery at the power-house. The cyanide plants of both mills are in successful operation, treating all the mill-tailing with satisfactory results. At the Central plant the cyanide process has been successfully adapted to the treatment of the sulphide product of the mills, yielding better economical results than were formerly obtained by chlorination or smelting.

The present condition of the property and its equipment is in all respects satisfactory; while the prospective outlook is reassuring and very encouraging.

LUCKY-TIGER COMBINATION GOLD, SONORA, MEXICO.

The Lucky-Tiger Combination Gold Mining Co., a Kansas City corporation, operating at El Tigre, District of Moctezuma, in the State of Sonora, Mexico, reports for the year 1907 a net profit of $283,662, from 15,255 tons of ore, having a value of $655,875, or $238 per ton. Of the above output, 1768 tons was shipped as mined, yielding $255 per ton, and 13,487 tons went through the mill, producing 980 tons of concentrate, worth $204,185, or $208 per ton. The operating profit was $386,053, and the net profit after adding income from rents and store was $409,022. Expenses at the home office, including interest on a $400,000 bond issue at 6%, was $26,370, to which was added cost of litigation amounting to $98,988, reducing the net gain on the year's operation to the figure first given. The gross value of ore and concentrate produced to date is $1,428,875, and the net return to the company, after paying freight and export duties, was $1,308,427. The total output of the property has been 15,693 oz. gold and 1,851,401 oz. silver. Out of the net operating profits the sum of $115,518 was expended on improvements, and $500 was paid as the purchase price for the Espuela claim, making $116,018 put back into the property, leaving a balance of $167,644 applicable to the payment of dividends or to the retirement of bonds. According to the terms of the mortgage the company is obliged to retire bonds at the rate of $5000 per month beginning with April, 1907, and $7500 per month beginning March 31, 1908, so that, having purchased and retired bonds to the amount of $92,800, the company has not only fulfilled all requirements to date, but has more than anticipated such obligation as far ahead as June 30, 1908. The report mentions a net undivided profit of $548,964, but this represents operating profit as shown on the books, and is evidently not a surplus in hand available for distribution. To that extent the statement, as made, is misleading. The company's policy of absorbing a portion of net earnings into betterment, instead of hastening to declare dividends, indicates a disposition to make money out of mining instead of from stock manipulation.

The Lucky-Tiger property was operated from May, 1906, to December, 1907, by an interventor appointed by the Mexican Court, pending a decision of a spectacular case involving a seizure of the mines and works in 1905 by an armed band under a pretext which the Supreme Court has failed to justify. The closing of this romantic incident, under the attendant circumstances, is as much a vindication of the stability of property rights in Mexico, as of the company's pretensions.

GATES ELEVATORS.

Gates elevators exceeding certain lengths, are made in sections joined together by iron plates and bolts. Erect the elevator as nearly as possible on the same angle as shown in plan for erection of plant, as their efficiency diminishes if they are either too flat or too steep. Be sure that your foundation is solid enough so that there is no liability of its settling and see that it is perfectly level, so that when the lower end of the elevator rests upon it there will be no twist in the frame work. If both sides do not rest solidly on the foundation, either 'scribe' and 'trim' to fit, or wedge up with shingles. Having the frame work set and well braced on the back side, as shown in the plans, the manner of putting on the belt and attaching the buckets is as follows: Put a piece of pipe or wood through the arms of the lower pulley to keep it from turning. Put on the belt-clamps, allowing the lower end of the belt to lap on top of the upper end at least the length of two buckets, and stretch the belt somewhat looser than you would if the belt were going to be used for transmission purposes. Place a bucket on the belt with its upper edge flush with the end of the lap of the lower end of the belt, dividing the space on the belt equally, on each side of the bucket. Whittle the end of a stick small enough to enter the holes for the bucket-bolts and, dipping the end into paint, varnish, or ink; mark the belt through the bucket bolt holes. Place a piece of hard wood under the marked spots and with a belt-punch (two of which are sent with each elevator) punch a hole through each of the spots. Raise the belt and insert a bolt in each of the holes; place the bucket back in position and screw on the bucket with the socket wrench (which is sent with the elevator). Place another bucket close against the first bucket, mark, punch, and fasten same. You will now have the belt securely fastened together and can remove the belt clamps.

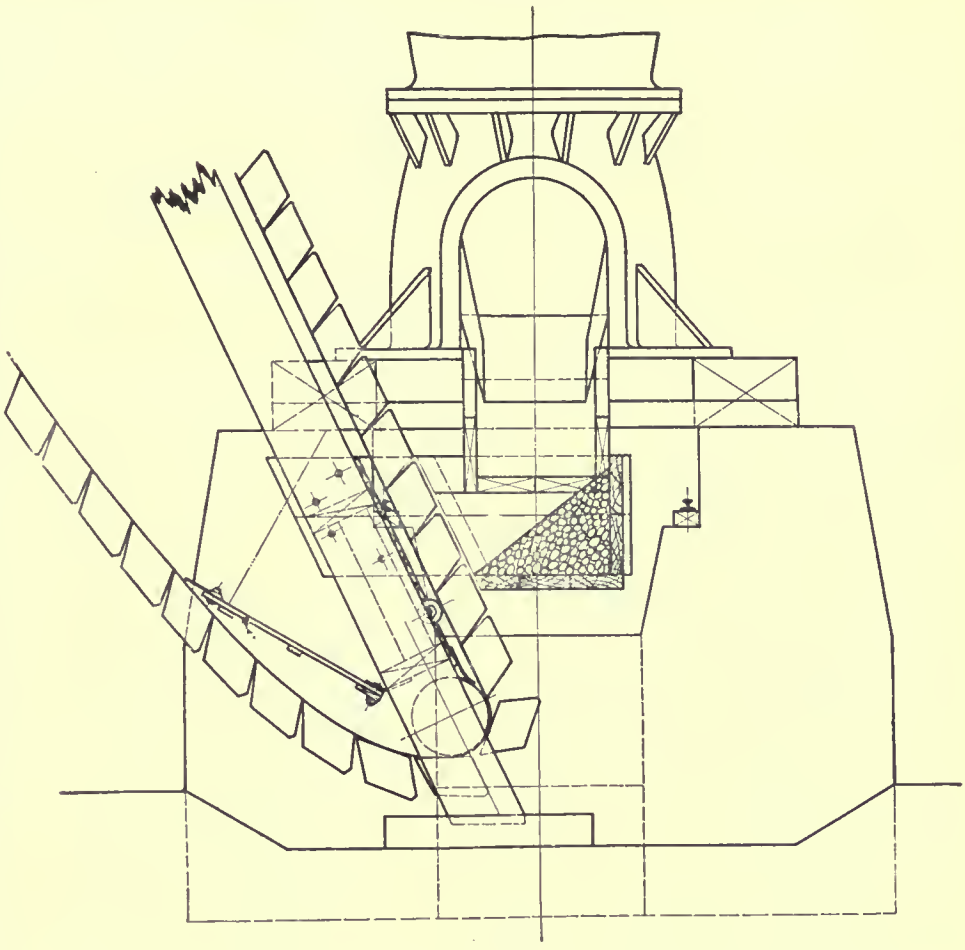


Fig. 1.

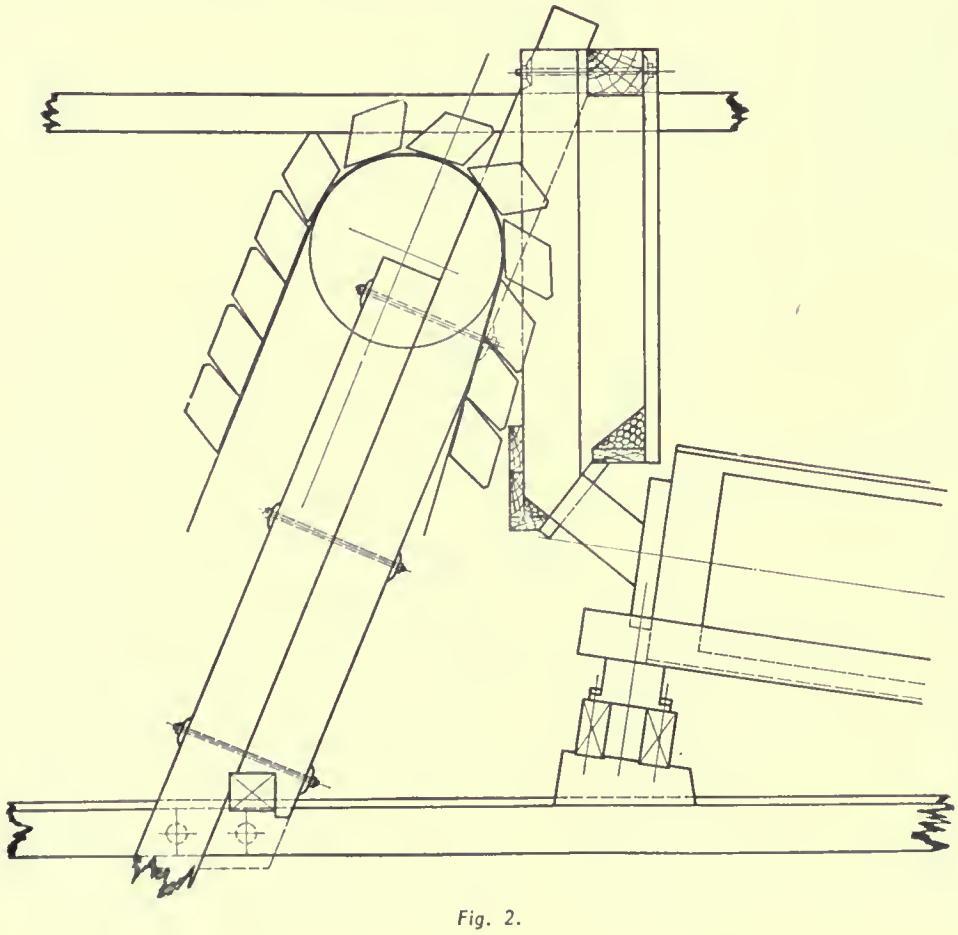


Fig. 2.

Let the two buckets drop down about the length of a bucket, and, putting another bucket close against the upper bucket, mark and fasten on the belt as heretofore directed. Fasten another above the last, and so on until all are on except about twenty buckets; then measure the space left on the belt (also measuring the length of one of the buckets) and divide any surplus over that required for the number of the buckets which will be needed, so that there will be an even amount of space between each

of the remaining buckets, and not the entire surplus space between the last bucket put on and the one above it. Oil the journals and put on the grease cups preparatory to starting. Do not stretch the belt too tight, but let it run with a large amount of slack so that it sags well out at the lower back side. If the belt stretches in use so much that the room in the tightener is exhausted, cut off the belt at the lap between the first and second buckets, and draw up the second bucket to its place; thus making the second bucket take the place of the first bucket, and the third bucket the place of the second, thereby completing the fastening of the belt as in the first instance.

When the elevator is to be stopped, run it at full speed until the buckets are empty. When shut down gradually with the buckets full of material, the stone cannot be properly discharged and falls between the bucket and the belt, punching holes through the latter and destroying it. A proper shield should be arranged over the inner face of boot pulley, as shown in Fig. 1, to prevent stone which may fall from above from getting between the pulley and belt, as this also results in destroying the latter. In spouting into the elevator there should always be two buckets on a straight line below the bottom side of the feed spout; this enables the second and third buckets to catch the material before it gets in behind the bucket that is just coming around the pulley. (See Fig. 1.) On the discharge or upper end of the elevator, it has been found the best practice to have no less than three buckets on a straight line above the spout, as illustrated in Fig. 2. This gives the stone more of an opportunity to drop into the spout of the screen, or any spout provided for the purpose, before being carried past and falling on the floor below.

COMMERCIAL PARAGRAPHS.

THE ATLAS CAR & MFG CO., Cleveland, Ohio, has issued bulletin No. 1065, describing side-dump cars.

THE BARTLETT & SNOW CO., Cleveland, Ohio, has issued catalogue No. 25, describing crushers, pulverizers, and feeders.

THE SWEETLAND FILTER PRESS CO., Los Angeles, recently shipped a Sweetland filter press to the Monica Mines Co., Kirkland, Arizona.

THE J. GEO. LEYNER ENG. WKS. CO., Littleton, Colorado, has issued bulletin No. 514, describing its line of steel-sharpening apparatus.

THE GOLDSCHMIDT THERMIT CO. announces the establishment of a branch office and works at 103 Richmond St., West, Toronto, Canada.

THE HENDRIE & BOLTHOFF MFG. & SUPPLY CO., Denver, Colorado, has issued its regular monthly Announcement and List of Machinery and Supplies for May.

ALLIS-CHALMERS CO. has issued a publication called 'Modern Rock-Crushing Plants,' containing information on the installation of machinery used for crushing.

THE C. H. SHAW PNEUMATIC TOOL CO., Denver, Colorado, recently received an order for 50 Shaw Eclipse Air Hammer Rock Drills, to be shipped to the Copper Queen, Bisbee, Arizona.

THE NATIONAL ORE CONCENTRATION CO. has moved its general office from Milwaukee to 1730 First National Bank Bdg., Chicago. Mr. E. T. Wright will continue to represent its interests in the capacity of president and manager.

THE BEHREND DRY CONCENTRATOR CO. has sold the full rights for manufacturing the Behrend Concentrator in Canada to Barnnell Sawyer of Montreal and Louis P. Jennings of Cobalt. The Canadian company will be called the Behrend Dry Concentrator Co., Ltd., of Canada.

L. S. PIERCE, 1650 Champa St., Denver, Colorado, manufacturer of the Pierce Amalgamator and gold-saving device, recently shipped two of his machines to the Mining & General Supply Co., London; one 25-ton machine to Harron, Rickard & McCone, San Francisco; one machine to Trinity Gold & Timber Co., of California; one 50-ton plant to the Piedmont M. & M. Co., of Georgia; one 20-ton machine to Zarina M. Co., of California; one 40-ton set of riffles to Joshua Hendy Iron Works; two 22 by 48-in. machines to C. H. Smetzer; and two 20-ton plants to the Smuggler-Union M. Co., Telluride, Colorado. This last shipment makes 21 machines in all now in use at the Smuggler-Union mill.

BOOKS RECEIVED.

HYDRAULIC TABLES AND MEMORANDA. By H. D. Jerrett. 12 mo., pp. 144. Published by the author, San Francisco. 1908. Price $1.50. This convenient vest-pocket collection of tables and data for ready calculations in the field will be welcome to those having reconnaissance work to do where access to larger treatises is not possible. It covers all the ordinary ground needed in the solution of problems arising in connection with irrigation and water-supply engineering. For sale by the MINING AND SCIENTIFIC PRESS.

TECHNICAL METHODS OF ORE ANALYSIS. By Albert H. Low. 3d. Ed. John Wiley & Sons. 1908. Price $3. This is not a mere re-print. Much new matter has been incorporated in the text, particularly with reference to aluminum, antimony, arsenic, calcium, lead, magnesium, nickel and cobalt, tin, uranium, zinc, coal and coke. The appendix has also been expanded, bringing the work as nearly up to date as possible. In the effort at keeping abreast of progress in analytic methods, the author has gone so far as to add late notes on the chromate-oxalate method for lead in the form of an inset put into the book after it had been printed. For sale by the MINING AND SCIENTIFIC PRESS.

DEVELOPMENT AND ELECTRICAL DISTRIBUTION OF WATER POWER. By Lamar Lyndon. pp. 317; ill.; index. Price $3. John Wiley & Sons, New York. 1908. This volume deals in a broad way with the inter-relationships of water-power, methods of development, machinery and apparatus employed, and the final use to which the energy will be put. It is not a technical treatise, but is such a review as would prove useful for its suggestiveness to a busy man who had such problems as are involved in the development and transmission of electrical energy presented in connection with other activities. It points out all the elements of the problems, and would serve as a guide to one not a specialist in such work, who desired to acquaint himself with the conditions of modern practice. It contains matter of value relating to the practical management of turbine wheels, and is enriched with descriptions of some of the leading electric power-plants in the world, including the Taylor's Falls-Minneapolis plant, and the Kern river installation of the Edison Electric Co., in California.

ENGINEERING REMINISCENCES. By Charles T. Porter. 8vo., pp. XIII, 355. John Wiley & Sons, New York. 1908. Price $3. For sale by the MINING AND SCIENTIFIC PRESS. Most reminiscences by men who have been more conspicuous as doers of the world's work than as writers about it, turn out to be a mere dreary recital of experiences so intensely personal as to have little interest for those outside the circle within which the author was a familiar figure. Such is far from being the case with the memoirs of Mr. Porter. He has been, in his own person, through brilliant achievement, a large part of the history of the development and perfection of steam engineering in the last half-century. He has been the close friend and collaborator of the great men who have played a leading part in expanding the efficiency of the race by giving it control of gigantic power-machinery. Thus he evokes from his rich experience vivid pictures of such spirits as Charles B. Richards, John F. Allen, Frederick E. Sickels, Sir Joseph Whitworth, Alexander Holley, and a host of others. Moreover, the volume is written with dash and brilliancy, and is brimming with humorous anecdote. It is the kind of book that helps the world to understand and properly measure, as men and as masters of the mechanic arts, those great engineers who have been essential factors in building the structure of modern civilization.

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Editorial.

SINCE OCTOBER the seven stocks controlled by the seven Guggenheim brothers have appreciated $39,372,832. We get that figure from the *Boston News Bureau*. These seven stocks represent an aggregate capital of $171,416,800. Is it not strange that financiers responsible for such big sums of money should be so eager to make a million or two through the buffoonery of Lawson?

GOLD PRODUCTION in Australia diminished during the first quarter of this year, the total yield being 840,597 ounces, as compared to 875,782 ounces in the corresponding period last year. But New Zealand shows an increase, from 111,465 ounces to 123,325 ounces, so that the net decrease in Australasia is only 35,135 ounces for the quarter. The increase in New Zealand is due mainly to the Waihi mine, in the Hauraki district.

OUR Discussion department is enriched by a letter from Mr. W. A. Caldecott, writing from Johannesburg. This eminent cyanider acknowledges himself to be the 'Viator' who initiated the exchange of opinions in regard to the treatment of an ore containing both coarse and fine gold. To the discussion that ensued Messrs. Philip Argall, E. M. Hamilton, Edward H. Nutter, C. W. Van Law, Edwin C. Holden, E. P. Kennedy, George A. Packard, Walter L. Reid, E. A. H. Tays, and James S. C. Wells have contributed. Some useful information has been elicited. We hope that other men will be prompted to ask leading questions and provoke enquiries of a similarly useful character. This journal is meant to be the medium for such exchanges of ideas and of experience.

FROM NEW YORK we learn that Mr. Henry S. Munroe, of Columbia University, has been elected president of the Mining & Metallurgical Society of America. The vice-presidents are Messrs. Waldemar Lindgren, of the Geological Survey, and C. R. Claghorn, of Tacoma. The treasurer is Mr. W. R. Ingalls, editor of *The Engineering and Mining Journal*, and the secretary is Mr. J. R. Finlay. These are all excellent selections. The choice of president is particularly good, for Mr. Munroe was chairman of the committee on organization and did efficient work in that capacity. As a high type of professional man he is well fitted to be the standard-bearer. The executive committee will consist of the three New York members of the council, together with Messrs. R. H. Richards of Boston and F. Lynwood Garrison of Philadelphia, the idea being to have a committee the members of which are all within easy reach of New York. The first Bulletin will be prepared and issued forthwith; it will contain an introduction

explaining the purposes of the society, the constitution and by-laws, besides the list of officers and members. Arrangements will be made to start discussions during the coming winter, and it is likely that the standardization of cost-sheets, annual reports of mining companies, and the like will be brought forward. Applications for membership are numerous and a high standard is being maintained. On the whole, prospects are most promising for a successful and useful enterprise.

BUSINESS RELATIONS between San Francisco and Mexico will be much improved when we have a good steamship service to the west coast of the Southern Republic and railroads from the coast to the interior plateau. There is a good deal of railroad construction under way, the effect of which will be to connect the Pacific ports of Mexico with the City and with the mining regions of the Sierra Madre. In July the new line from Guadalajara to Manzanillo will be open. We need a better steamship service, and in this connection it is a pleasure to chronicle the fact that the French line of the Chargeurs Réunis has arranged to call at Mazatlan and Guaymas, and later at Manzanillo also. On June 3 the *Ceylan* of this line will sail from San Francisco, and other boats will follow at intervals of six weeks. These vessels are large, commodious, and well equipped for first-class passenger traffic. We hope that this will prove the beginning of a new commercial link between this port and the mining regions of western Mexico.

IN A RECENT issue of the *Nevada State Journal* we find an account of the geology of Jessup that reminds us of the comic treatise on 'The Geology of Jell' written by a learned friend in Columbia University. A newspaper geologist, whose name we forbear to mention, hoping that he may yet learn the evil of his ways, states that "the country is secondary, to all appearance and analysis. From a common level of monotonous basins, internal pressure causing heat, or the residue of nebulous matter seeking a vent, has forced up secondary formations where the crust had the least resistance, resulting in fissures conforming to interior activity, preponderance of weight on the surface and local conditions. In most instances this action was gradual as a growth, denoting the absence of violent or seismitic action, which occurs only as a secondary at rare intervals in the district. These fissures have been filled up with intrusive matter by an upward pressure of soft and silicious elements; have been subjected to heat and rest, admitting of mineral precipitation; fed by extrusive, intrusive and extraneous secretions. Probably long inundation admitted of percolation and infilteration of congenial elements acting as reagents. Do these fissures persist in depth? They should, if our theory is correct. With rest or coolness on the surface, resistance will be greatest on the upward heave at the surface provided the action is slow; this argues a widening of the fissure from the apex down," and so forth. The spelling is unchanged. Two columns of this sort of stuff that will cause a man to doubt the sanity of the editor who allowed such rubbish to get into print. The country may be "secondary" but the geological analysis is primary rubbish swept from a bar-room floor. The basins may be "monotonous" but not nearly so monotonous as the dreary level of balderdash masquerading as science. The fissures may have been "filled with intrusive matter" but never so choked with useless emanations as the columns of the *State Journal*; they may have been fed by "extraneous secretions" but never so overwhelmed with hot air as the readers of that Reno newspaper. The "widening of the fissure from the apex down" suggests a limbo for the disposal of pseudo-scientific rigmarole. Poor old Jessup. The unkindest depreciation of that young mining camp could never have hurt it so much as the publication of the paretic rot of this Reno geologist.

Fundamental Facts.

TECHNICAL RESULTS as quoted in print are apt to be misleading if accepted as representative of average working results obtainable in good average practice. They too often represent the best that has been obtained, or that appears to have been obtained, in selected periods or campaigns, when free from the influence of accidents or difficulty. Students should be prepared to make some allowance, as is the wont of their experienced seniors, for the effects of accident, delay, or the oversanguine enthusiasm of observers, weighers, and the like. The differences between cost, consumption, and yield estimated from short runs are often more favorable than those obtained in the long run, as proved by the logic of stock-taking and the closing of accounts after every expense has been included. What we may call the accountant's cost is generally much higher than that estimated by the foreman or others in charge of the operation. For instance, the copper content of a slag as stated for publication is likely to be less than the actual average because a low assay has been selected for the purpose. The consumption of coke in pyrite smelting also may be that of the official charge-sheet and not that actually used by the men at the furnace, and if it cannot be stated as the average of a sufficiently long period and confirmed by the half-yearly or yearly stock-taking, or such control as the financial interests of the undertaking compel, then it must be regarded as largely ideal. The true test of the amount of copper left in the slag is the sampling and assaying of the dump. The true test of the coke consumption is the quantity the company has paid for, after proper adjustment for stocks at the beginning and end of the financial period. We recall an analysis of blast-furnace gases from the Antipodes that appears to have puzzled an able investigator of metallurgical proportions, namely, Mr. J. W. Richards. The theory of the smelting offered with the analysis was based on ideal conditions and the actuality of practice may have differed from this ideal. More coke or limestone may have been used than was suggested by the ideal case.

There are two fundamental principles upon which

our modern science rests: The conservation of matter and the conservation of force. From so much carbon consumed in a certain way we get so much heat. We cannot get more. From 778 foot-pounds of energy we can get one heat unit and no more. From one pound of any matter we can get no more. We can neither destroy nor create; but only change the form.

Affairs in San Francisco.

FRIENDS in New Zealand and South Africa write asking us what progress is being made in the civic rehabilitation of San Francisco. The question makes us feel ashamed. In New Zealand representative government is in a forward state of development even though the Ultima Thule of democratic ideal has not been reached and in South Africa measures are being taken with a view to a federation of the States and the formation of a political Union. It is not to be wondered that those engaged in mining in those two progressive, though distant, regions should want to know how far San Francisco has recovered from the youthful distempers of representative government. "Watchman, what of the night?" We are compelled to reply that it is dark overhead, a mist makes it dangerous to the wayfarer, the stars are in eclipse, and wise men had better keep indoors. For indeed the outlook is not cheerful. The cause of good government is receiving scant support, the rich criminal walks the streets confidently, Justice is outraged, the administration of Law is disgraced, and Wrong is still defiant.

San Francisco's troubles began with the dominance of the labor union. The men who labor had to combine to protect themselves, for only by the force of combined action could they exact their share of industrial prosperity. Having discovered the power of combination, the labor unions went into politics. They made one of their own men the Mayor of the City and obtained control of the municipal government. The nominees of the labor party proved to be crooks. An exposure followed. On the top of a wave of reformation an honest Mayor and a reputable board of aldermen were elected. An effort was made to punish those who had enriched themselves by bribery and other ways of corruption almost unspeakable. It was found that the merchants of the City and the captains of industry were accessory to the crimes, already partly investigated and exposed. All the power of the men in control of State politics, a large part of the financial power of the banks, a preponderance of the social power of the rich and fashionable people of the City united in an effort to stifle the prosecution of the offenders against civic integrity, as soon as their own friends and associates were implicated. The crooks of the Labor party went into offensive and defensive alliance with the crooks of the Corporation party. The better kind of laboring man saw that if his leaders were crooked, the leaders of the capitalist class were no better, and if money was to be made crookedly, his own leaders might as well have it. The labor unions began the undermining of civic decency in this community; the corporations completed it. Thus the professional man, the average honest laborer, the average honest merchant, the average honest citizen, found himself between the upper millstone of the corrupting corporations and the nether millstone of the corrupted labor unions. That is the plight of San Francisco today.

One incident will suffice to indicate the true condition of affairs. Louis Glass, the vice-president and general manager of a telephone company, was indicted, tried, and convicted of bribing the supervisors or board of aldermen. It was proved that $55,000 of the telephone company's money had been used for bribery and that $7500 was returned by some supervisors who accepted bribes from a rival telephone company, anxious to get permission to do business in the City. In the code of thievery, a man who takes bribes from both sides is not honest, but one who stays bought is a real gentleman! The official—named Zimmer—who took the money from the telephone company's treasury, and handed it to the go-between who paid it to the supervisors, gave evidence before the Grand Jury but refused to testify in the trial of Glass, his superior officer, and was sentenced to jail. This effort to shield crime was hailed as loyalty. Not long afterward, while Glass was still in jail, unable to attend to any business, and unlikely to be able to take part in any of the affairs of the company, the directors of the Pacific Telephone & Telegraph Company met and re-elected Glass second vice-president and Zimmer third vice-president of their company. The directors of this company include some of the "best citizens" of San Francisco. By their action they set the seal of their approval on crime, they honored a man duly and properly convicted of a felony, and they asserted their right to flout Justice.

Meanwhile eight or nine trials have followed and all save one have ended either in acquittals, in disagreements of the jury causing a mistrial, or in reversals of the verdicts of the lower court by appeal to the Appellate and Superior Courts. On the whole, the efforts of the District Attorney and of the men in his office have failed, except in so far as they have exposed the true condition of affairs. The judges of the Superior Court, before which the trials take place, are chosen in a political election and owe their position to political considerations in a State where the political power is in the hands of a railroad company. In fairness to the particular judges before whom these trials came, it must be said that they were partial to the prosecution, even though honestly. They exhibit the defect of the system under which they are selected, by giving rulings that are open to reversal in the higher courts, and such reversals have already destroyed much of the work accomplished, with temporary success, by the prosecution acting for the community. The District Attorney is a school-teacher who by the sport of politics became nominated to his important office and held it because of his honesty, but not by reason of any special ability. He has been assisted by Francis J. Heney, a fearless advocate and the leader of the

forces of the prosecution, which has been financed, not by the City, but by a private citizen and an honorable man named Rudolph Spreekels. It is likely that the City will relieve him of the burden of finding money for the defence of its integrity. But what a topsy-turvy condition of demoeraey! Save for the public spirit and courageous purpose of a handful of men it would have been enough to depress the fondest believer in the representative form of government. And through it all the power of the press —the supposed palladium of our liberties—has been at first covertly and then openly in favor of the corrupters even when it was not frankly for the corrupted. Journalism has been hired to do the meanest tricks, journalism has been paid to do the most servile duty, journalism has proved itself the friend of crookedness and thievery.

The press has been prostituted, and even the profession of the law has played into the hands of wrong-doers. Seeing that the District Attorney was a poor lawyer but honest, seeing that the City's real advocate was over-worked, harrassed, and open to criticism in some respects, might it not be supposed that scores of the ablest lawyers in the community would have volunteered their services in the cause of the City and have given their counsel to their legal brethren who were making such a splendid uphill fight. Not at all! We are sorry to tell our friends in New Zealand and South Africa that the leaders of the bar, the legal talent of the community, the great brains of a noble profession were given to the cause of wrong, to the protection of the criminal, to the subversion of right. In this City at this time the profession of the law is largely devoted to the suppression of Justice and to the evasion of Law; nine out of every ten of the leading members of the bar are busy showing rich men how to do wrong and yet evade arrest.

Even trial by jury has been undermined. Most of us have believed that a jury was an epitome of public opinion and that, come what might, a jury could be relied upon to deal justly. But even in this department the seed of corruption has been plentifully sown. The Grand Jury, before which a suspect is called before indictment, is selected by the Judges of the Superior Court; each of the 12 judges chooses 12 men, making a list of 144 names out of which the Grand Jury of 18 is chosen. Some of the pals and partners of the crooks were placed upon this list and it can only be guessed how and why. In selecting the petty juries, the procedure is different. In the counties of California it is the duty of the chairman of the board of supervisors to select names to be placed in the jury-box, but the sheriff and clerk of the Court must be present. In the City, the judges of the Superior Court select the names to be put in the box; the men chosen must be taxpayers and it is usual for the selection to be made from the precinct register. Each of the 12 Superior judges selects 200 names and these 2400 names are placed on slips of paper in the jury-box. As a matter of fact the selection is apt to be deputed by the Judge to the Clerk of the Court and by him to his deputy, so that in one way or another an opportunity is given for those interested to stuff the box with the names of men amenable to corruption. The railroad company, the street railway company, and other corporations having frequent damage suits for accidents, find it profitable to maintain an organized secret service devoted to the doctoring of jury-boxes, the corrupting of those selected, and the obstruction of those who may prove obdurate. One of the crooks, who was also the main go-between in the bribery of the municipal officers, and the political boss of the City, is named Ruef; he is a Jew; it was more than a coincidence that every other man drawn from the panel in the recent trial was a Jew or a saloonkeeper, or both. In the trial of the ex-Mayor fully one out of every three of the men drawn proved to be saloon-keepers or cigar-dealers who sold pools on the races, that is, men likely to be involved in such illegal acts as would keep them under the thumb of the police. Through the police force, which was headed by a crook and is now headed by a well-meaning duffer, it was easy to control these possible jurors. Further, the men on the list are called to the Court by the Sheriff or his deputy; it is easy to notify certain men to be absent when the summons to duty arrives, and to inveigle others away. Thus, and in other ways, it is possible to fix the jury. In the last case tried, two ex-convicts were actually impanelled and provisionally accepted as jurors, and it was only by good luck that their record was ascertained by the District Attorney's office before they were sworn in to try the case. There is no doubt that the lawyers for the defence knew the antecedents of these men and thought it proper tactics to get them on the jury in aid of their client. And to be fair, it is proper to say that even the prosecution will wink at the selection of a juror whom they know to be biased, if the bias be toward their own case. In combating the trickery of the criminal and of his criminal attorney, there is a tendency to fight the Devil with fire, instead of a hand-grenade.

The gentlemen in New Zealand and South Africa will not find much encouragement in this picture; they may feel prompted rather to adopt the beneficent despotism tempered by industrialism of Mexico or the military autocracy modified by revolution of Colombia than the corrupted government "by the people and for the people" in this American city of San Francisco. And yet it may be well for them to wait and watch. It is useless to promise and it is vain to predict. We still have faith in the uncorrupted core of essential manhood that makes for American progress. Our City will yet redeem herself—she *must*. San Francisco stands at the gateway of Occidental civilization, facing the re-born world of the Orient. Is the Caucasian to confess himself played out? Shall a Chinese mandarin or a Japanese merchant point to our corporation officers as types of indirection, inicivism, and graft? Not long ago a Mexican of the *plebe* class visited San Francisco and on his return to Zacatecas, he told an American mining engineer that San Francisco was too dangerous a place for him and he had decided to come back to Mexico! Anyone who has lived in Mexico will appreciate the sardonic humor of this true story.

Personal.

R. A. F. PENROSE is here.

RALPH NICHOLS is in Idaho.

GEORGE A. PACKARD is in Arizona.

W. H. WEED is in British Columbia.

F. J. H. MERRILL is here from Nogales.

W. E. THORNE is at Redding, California.

W. A. PRICHARD is here from Mexico City.

THOMAS RICKARD was at Goldfield this week.

H. N. TOD is at Ballarat, Inyo county, California.

H. C. WILMOT, of Butte, is here on a brief holiday.

F. R. WEEKES is now in Florida on professional work.

FRITZ WOLF is in San Francisco from Mazuma, Nevada.

W. J. SHARWOOD has returned to Lead City, South Dakota.

JOHN W. PROUT, of Denver, was lately at Globe, Arizona.

A. H. ELFTMAN, of Tonopah, was in San Francisco recently.

J. MORGAN CLEMENTS, was married at New Haven on May 8.

H. KILBURN SCOTT is on his way from London to Nova Scotia.

O. B. PERRY passed through San Francisco on his way to Dawson.

AUBRY RYLAND is superintending a lease at Seven Troughs, Nevada.

LYMAN BRIDGES is manager for the Acme Mining Co., at Tucson, Azizona.

J. PARKE CHANNING is expected in New York, on his return from Europe.

CHARLES D. KAEDING, of Goldfield, came to San Francisco from Los Angeles.

HENRY BRATNOBER is at Seattle, preparing to go to the Seward Peninsula.

GEORGE A. SCHROTER has gone to Nevada and will proceed shortly to New York.

RICHARD SNELL sailed for Salvador on May 22, to be assayer at the Devisadero mine.

F. PERCY ROLFE, manager for the Keystone mine, in Wyoming, is on a visit to London.

FRANK OLIVER has returned to Goldfield, after a short holiday in southern California.

R. B. NICOLSON, the manager of the Ivanhoe mine, Kalgoorlie, is expected in London.

D. M. RIORDAN is here from New York, on his way to the Bully Hill mine, in Shasta county.

R. S. RAINSFORD, manager of the Argonaut mine, at Jackson, California, was here this week.

W. A. HEYWOOD has concluded his visit to Namaqualand, South Africa, and is now in London.

PATRICK KELLY, from Karangahake, New Zealand, was in San Francisco, on his way to Nevada.

FRANK H. PROBERT has been appointed consulting engineer to the Superior & Boston Copper Company.

EDWIN H. DAVISON, until recently in charge of mines at Fundicion, Mexico, is visiting San Francisco.

H. W. DUBOIS, of Philadelphia, is on his way to British Columbia. Later, he will proceed to Dawson.

T. SKEWES SAUNDERS is now superintendent of the Teziutlan Copper Mining & Smelting Co.'s mine at Ejutla, Mexico.

LOUIS A. WRIGHT is general manager and F. C. ALSDORF is superintendent for the Miami Copper Co., at Globe, Arizona.

E. H. SIMONDS has removed to Room 416, Crocker Bdg., San Francisco. His laboratory remains at Oakland, California.

HENRY CRUMM has been appointed to make a special examination of the Tonopah Extension mine, at Tonopah, Nevada.

CARNEY HARTLEY has opened an office at 204 Empire Bdg., Denver, and will design, install, and operate placer mining machinery.

W. R. CRANE, lately in Columbia University, has been chosen Dean of the School of Mines and Metallurgy of the Pennsylvania State College.

W. W. WISHON has returned to Los Angeles after making an examination of the properties of the Tucson Consolidated Copper Co., at Tucson, Arizona.

E. MCCORMICK has assumed the management of mines and smelter of the National Mining & Smelting Co., with headquarters at Deming, New Mexico.

EDWIN C. HOLDEN has accepted the appointment of professor of mining engineering in the University of Wisconsin and has retired from the firm of Hill, Holden, & Irvine.

J. S. HAMMAN and C. E. JAMISON have formed a partnership as mining engineers and metallurgists, and have opened an office at 1034 Central Bdg., Los Angeles. Mr. Jamison retains his connection with the De La Mar mines.

Latest Market Reports.

LOCAL METAL PRICES—May 28.

Antimony	12@16c	Quicksilver (flask)	$45@45.50
Casting Copper	14¼@15¼c	Spelter	6½@ 7¼c
Pig Lead	4.70@ 5.65c	Tin	32½@34c

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date	Electrolytic Copper	Lead	Spelter	Silver
May 22	12.69	4.27	4.58	53⅜
" 23	12.69	4.35	4.58	53
" 24	Sunday.	No market.		
" 25	12.69	4.35	4.58	53¼
" 26	12.56	4.35	4.58	53⅛
" 27	12.56	4.35	4.58	53
" 28	12.56	4.35	4.58	52⅞

ANGLO-AMERICAN SHARES.

Cabled from London.

	May 21. £. s. d.	May 28. £. s. d.
Camp Bird	0 13 3	0 13 0
El Oro	1 4 6	1 4 4½
Esperanza	1 6 3	1 6 3
Dolores	1 5 0	1 5 0
Oroville Dredging	C	0 11 6
Stratton's Independence	0 1 6	0 1 7
Tomboy	1 11 3	1 12 6

(By courtesy of W. P. Bonbright & Co., 24 Broad St., New York.)

MINING STOCK QUOTATIONS—NEW YORK.

	Closing prices. May 28.
Amalgamated Copper	63½
American Smelting & Refining Co	72⅝
Boston Copper	11⅛
Butte Coalition	22½
Cumberland Ely	7¾
Dolores	6½
El Rayo	1⅞
Giroux	3
Greene-Cananea	9⅝
Indiana Sonora	4¼
Miami Copper	4¾
Micmac	3½
Nevada Consolidated	11¾
Newhouse	7⅜
Nipissing	7
Ohio Copper	2⅝
Tennessee Copper	36⅞
Utah Copper	30⅞
Yukon	3⅜

(By courtesy of Trippe & Co., 25 Broad St., New York.)

SOUTHERN NEVADA STOCKS.

San Francisco, May 28.

Atlanta	$ 18	Laguna	1.05
Belmont	90	Manhattan Con	10
Columbia Mtn	13	Midway	37
Combination Fraction	40	Mizpah Extension	10
Daisy	95	Montana Tonopah	1.42½
Fairview Eagle	37	Nevada Hills	2 20
Florence	3.05	Rawhide Queen	2.00
Gold Bar (Bullfrog)	6	Sandstorm	23
Goldfield Con	5.12½	Silver Pick	11
Gold Kewanas	25	St. Ives	30
Great Bend	26	Tonopah Extension	89
Jim Butler	23	Tramp Con	16
Jumbo Extension	25	West End	36

(By courtesy of W. C. Ralston, 353 Bush St.)

General Mining News.

ARIZONA.

GLOBE COUNTY.

The Old Dominion is planning to carry the water of Pinal creek through 5000 ft. of flume to Steads' ranch, to prevent its seepage into the mine. The water pumped from the mine will be carried to the main flume.

GRAHAM COUNTY.

The output of the Arizona Copper Co. for the month of April was 150 tons of bessemer copper, and of the Shannon Co., 725 tons.——The Home Copper Co. has let a contract for driving the Lillian adit 1500 ft. through Buzzard Shadow Mtn. The adit is in 700 ft. and has passed through several streaks of rich ore. Another gasoline hoist will probably be put in the adit and sinking started on some of the veins. The Home company has also let a contract for sinking the shaft on the May mine 300 ft. deeper.

MOHAVE COUNTY.

A rich strike is reported in Boulder canyon, 10 miles below Bonnelli Ferry. The vein is said to be 10 ft. wide and to show an outcrop more than a mile in length.——The Yucca Cyanide M. & M. Co., at Cedar, lost their assay office by fire last week.——It is reported that the Aztec Turquoise Co., at Mineral Park, will start work soon. Two other companies are now working.——The New London mine, near Cerbat, is working a small force sinking a new shaft.

PINAL COUNTY.

The Copper Creek Co. has 9 six-horse teams hauling machinery and lumber to Sycamore Flats, in Copper canyon, and it expects to have its concentrator running by July 1. The townsite is being laid out.——It is rumored that a 40-stamp mill is to be built on the Mohawk property at Mammoth. A cross-cut has recently been completed on the 350 level, and another started on the 400. When the latter is completed stoping will be started.——Fifteen men are employed in developing the Leatherwood property, in Catalina Mtn.——Harner & Hand report a strike of a 6-in. vein of gold ore which it is claimed will assay $100 per ton, with some specimens running as high as $1200.

CALIFORNIA.

NEVADA COUNTY.

(Special Correspondence).—A small vein of rich ore has been struck in the hanging wall in the 500 level of the Idaho-Maryland. Work is under way to determine the extent of the discovery, and men are being added as rapidly as they can be used. The main vein has widened from 6 to 10 ft.——Rich gravel and a 16-in. quartz vein have been discovered on the Kohler ranch, a few miles northwest of Grass Valley.——Joseph O'Keefe and W. T. Crase have leased the South Idaho mine and will sink a new shaft at some distance from the old workings.——A deposit of rich gravel has been developed on the claim of the Weare Bros., seven miles north of Banner Mtn. The channel is 200 ft. wide and 40 ft. deep. An adit will be driven to open up the deposit. Considerable black sand carrying gold is in sight.——A good body of high-grade ore has been struck in the adit of the Central Consolidated mine. The quartz contains sulphides and some free gold.——The working force at the Brunswick has been reduced. Most of the ore is coming from the 900-ft. level.——It is reported that the Norambagua mine will be re-opened and worked by Shasta county mining men, who recently inspected the property.——Another good ore-shoot has been struck at the Red Ledge claim. The owners are pushing development.

Grass Valley, May 26.

TEHAMA COUNTY.

The Bonanza mine in Harrison gulch, operated by the Victor Power Co., has received a 15-hp. hoist, 500 ft. of cable, shafting, buckets, boilers, etc., and they are now being hauled to the property. The shaft is now 100 ft. deep and will be sunk 400 ft. deeper.

TRINITY COUNTY.

The Nash mine, on Coffee creek, has been leased to James W. Furness, and not to Gordon Abrams as stated in our issue of May 9.

TUOLUMNE COUNTY.

(Special Correspondence).—H. W. Gendar, who has taken a bond on the Anaconda mine, near Columbia, is sinking the shaft from the 112-ft. level, using electric power.——The El Oro mine (formerly the Oakland) will start its mill about June 15 with 5 stamps.——The United Mines Corporation, which controls a group of claims along the north fork of the Tuolumne river, is installing the equipment for its new 20-stamp mill. The mill will have a capacity of 120 tons per day, which will be increased if results warrant. The shaft on the New Albany, one of their claims, is now down 700 ft. and will be deepened 300 ft. more. An adit on the Lady Washington, another of their properties, is being pushed forward. The company uses electricity, generated by water obtained through a flume from the north fork of the Tuolumne river.——The plant of the Sierra Lime & Cement Co. is being rebuilt, and shipments of lime to San Francisco will be resumed.——P. H. Craven, inventor of a slime-table, is building an experimental plant at the Eagle-Shawmut.——Sinking is to be resumed at the Harvard shaft, which is now 800 ft. deep. Eighty men are employed and 40 of the 60 stamps are dropping. Numerous minor improvements are being made around the mine.——The Black Oak has been unwatered down to the 200 level.——A head-frame is being erected, a compressor installed, and other machinery put in at the Gold Crater, in the vicinity of Knight creek.——The Springfield Tunnel Co. has received a new engine and boiler.——The Imperial, near Jacksonville, has temporarily suspended operations, pending the collection of an assessment from the shareholders.

COLORADO.

GILPIN COUNTY.

The St. Louis mine, in Winnebago hill, is to be worked by New Orleans people under a lease and bond. There is now a 100-ft. shaft on the property, but the new company expects to sink another.——The Golden Flint mill (formerly known as the Rollins), at the head of Gamble gulch, was started last week on ores from the Golden Flint mine. A new boiler and a Standard table have been added to the mill.——The Iroquois Co. has let a contract for sinking its main shaft 100 ft. deeper and the work has started. When this work is completed the shaft will be 220 ft. deep and from there cross-cuts will be driven to develop the mine.——Four carloads of ore from the Champion and the Lone Star mines, in the Phoenix district, were received at the Fifty mill, in Black Hawk, last week. The ore came by way of Denver over the Moffat road.

GUNNISON COUNTY.

It is reported that John Patterson, who recently purchased the old smelter dump at Gunnison, plans to build a plant to treat the slag. The dump will assay $13 per ton, and is estimated to contain 75,000 or 100,000 tons.——The Blaine has undercut a large body of ore on the Alice claim, at Guthrie, at a depth of 125 ft.——The Black Queen management reports that the ore recently cut at the 70-ft. level has improved, and that a car of shipping ore will be sent out soon. The mill is running steadily.

LAKE COUNTY.

A force of men is at work on the old Starr placer property, under the Midland trestle west of Leadville, and it is announced that much ground in that vicinity will be washed during the summer. It was in this vicinity that the first important discoveries of the Leadville district were made, and the Starr property itself has already yielded several millions of dollars in mineral wealth, all coming in the form of pure gold gathered in fine particles from the dirt and gravel.——R. W. Foot will start work soon on the Wellington group, using electric power to sink a shaft.

SAN JUAN COUNTY.

The Hamlet mill is closed down pending the renewal of the rolls, but will be started again as soon as the work is completed.——It is rumored that the Polar Star, on Engineer Mtn., will be re-opened by Jack Carroll, after years of idleness. Large amounts of high-grade ore were taken from this mine in early days.——The Hercules Con. M. & M. Co. is working three shifts in its recently enlarged and remodeled mill. Regular shipments, averaging a carload per day, are being made.

SUMMIT COUNTY.

The second of the big dredges of the Colorado Gold Dredging Co., near Breckenridge, was started last week.——The Wire Patch mill, near Frisco, is running full-blast, treating the product of the several neighboring mines. The Wire Patch uses electrical power entirely, and is at present working two shifts.——The Reliance Gold Dredging Co. has been recently organized to work a large block of placer ground which it has secured near Breckenridge.

TELLER COUNTY.

H. L. Bull, who has leased the Fluorine property on Copper Mtn., is planning to open the old cyanide mill on that property.——Rains & Co. have uncovered a body of ore 2 ft. wide assaying $100 per ton, in the 400-ft. level of the Anchoria Leland, on Gold hill.——The Big Four leasing company on the Carbonate Queen recently shipped the last carload from the dump on that property.——The Old Gold property, on the west side of Beacon hill, has been leased to Mulvaney & Ganson, who expect to work it above the 400-ft. level. The Old Gold is flooded below that point, and the conntry rock is so dense that the water does not seep into the El Paso tunnel, which is 200 ft. lower.——The Isabella is shipping from 75 to 100 tons per day, coming from four different levels—the eighth, ninth, tenth, and eleventh. In addition, the cyanide mill is treating 100 tons of tailing per day. Two shifts are at work.

IDAHO.

IDAHO COUNTY.

(Special Correspondence).—The Buster 10-stamp mill is running night and day. Gold is saved on amalgamation plates and in cyanide tanks, while about 35 tons of concentrates monthly are shipped to Tacoma.——The Butte-Orogrande mine, on Crooked river, is operating its 20-stamp mill. About 40 men are employed.——The strike on Four Mile creek made some time ago, which showed tellurides of gold, has stimulated a number of locations there, but snow covers the ground and nothing can be done for weeks.——The Golden Crown, the Mountain Con., and the Del Rio mines, all near Elk City, have resumed development work.——A contract has been let to drive an adit on the Laura B. property, on Crooked river below the Thunder Mountain mine.

Elk City, May 23.

SHOSHONE COUNTY.

(Special Correspondence).—The electric hoist of the Hecla is now completed and mining will soon be resumed. The hoist is designed for a depth of 2500 ft. and a load of 3000 lb.——The Snowstorm is shipping ore at the rate of 500 tons per day, and it is understood this output will be increased by 200 tons within the month of June. Development in the long No. 1 adit is being pushed. With the improvements installed during the recent depression the Snowstorm is now enabled to operate at a cost of $1 per ton, and is said to be earning a good profit. More ore is now being shipped than at any time during the boom in copper. ——The East Snowstorm is driving a 600-ft. cross-cut from its 900-ft. main adit to tap what is said to be the Snowstorm vein. The vein is carried for 3000 ft. on the East Snowstorm property, and indications in development are said to promise a formation similar to that of the Snowstorm. Small assays in gold are constantly being found. ——The Rex, which was recently closed down, will be re-opened under a new management, B. M. Francis having retired. Debts of about $35,000 will be paid off at once, and the mine will be developed extensively before the mill is again put in operation. Clean shipping galena has been found in the drifts from the foot of the winze. This winze will be sunk 200 ft. deeper, where it is thought the shoots found above will meet the solid vein. During the short run 20 carloads of ore were sent to the East Helena smelter.——The drift on the Black Bear Fraction vein has now attained a depth of 70 ft., and during the last 40 ft. galena of increasing richness made its appearance. It will take 150 ft. more to come under the upper winzes, to which raises will be extended. A mill will be installed this summer.——The Tamarack & Chesapeake has filed its annnal report, which shows a net loss for 1907 of $24,941. This is due to heavy development which has been carired on.

Burke, May 25.

(Special Correspondence.)—An important strike is reported from the Paymaster mine, about a mile east of Ward-

Map of Idaho.

ner. The ore was uncovered in the upper workings after following a lead for over 100 ft. The ore is rich in copper and lead and the vein is 4 ft. wide. A mill will be built. ——The Stanley Con. M. & M. Co. has started a suit against the Hercules Mining Co. for the recovery of $27,500 damages. The suit is based on the ground that the Hercules has polluted the water-supply of the Stanley mill.——An assessment of ½c. per share has been levied on the capital stock of the Big Divide Mining Co., payable on or before June 8. ——It is expected that the Panhandle smelter will start about June 1. The management has been promised a good supply of local ore, but will treat nothing but silver, lead, and gold ores at present. The smelter will begin with a supply of about 250 tons of ore per day, and this amount will be gradually increased until the full capacity of 500 tons is reached. The copper equipment will be completed about October.——The Butte & Coeur d'Alene mine, near Mullan, is beginning to take an important place in the ranks of the promising dividend-payers. The property has just been the subject of a close investigation by the prin-

cipal stockholders and owners, and it is believed that the mine will commence shipments in the near future. It is claimed that the ore-shoot is a continuation of the Hunter vein. The face of the adit is in 670 ft. and will be run 500 ft. farther. The men are driving west on the vein recently cut and at the same time the cross-cut is being pushed forward. The company is financed for at least another year.——A group of financiers from Missoula has taken an option on the Mineral Farm property, in the Mullan district. The terms of the deal are not made public. The first payment has already been made and the option calls for a settlement in full before the end of the month. All the controlling stock has been placed in escrow with the First National Bank of Spokane.——Operations have been resumed in the Little Mint property on the Montana side of the divide. The adit will be completed in about three months. The property has a good outcrop of gray copper. ——The annual meeting of the Ruth Con. M. & M. Co. has just been held, and the old board of directors has been re-elected for the ensuing year. The whole face of the tunnel is in pay-ore, and the force of men at the property will be increased soon.——Development work has been resumed at the Sister property, between Wallace and Burke. The men are engaged in driving on the vein. An assessment of two mills per share has been levied by the company. ——An official statement has been issued to the effect that the force of men on the Lucky Calumet property, near Mullan, is to be doubled as soon as the snow has cleared sufficiently to allow transportation of provisions. Ten men are employed at present.——A gold nugget worth $240 has recently been found on property owned by Blaine Ward on Trail gulch, between Wallace and Murray.——During the past two weeks no development has been done on the Advance, near Mullan, on account of the air-pipe running out. A new pipe is being put in and as soon as it is in place the driving of the adit will be resumed.——An assessment of one mill has been levied on the stock of the Wonderful company, payable June 24. The proceeds will be applied toward the continuation of development work.——Another strike is reported from the property of the Tiger-Poorman mine at Burke. This strike was made in the 1300-ft. level and at a distance of about 900 ft. from the portal of the tunnel. The vein has been found to split, one section consisting of about 5 ft. of high-grade ore and the other of about 7 ft. of good concentrating ore. The full extent of the latter orebody has not yet been ascertained. None of the ore is being shipped. The mine is one of the properties of the Federal Mining & Smelting Company.

Wallace, May 25.

NEVADA.

ESMERALDA COUNTY.

It is reported that the townsite management at Rawhide Junction, at the head of Walker lake, has let a contract for a 100-ton mill, on which work must be started within 30 days.——The Daisy, at Goldfield, has broken ground for its new mill, and will when it is completed treat its own ores. The main shaft is being enlarged to a three-compartment.——An orebody 14 ft. wide, which it is reported assays $20 per ton, has been uncovered on the property of Johnny Frank a few miles west of Lida.——The St. Ives has during the past week struck a body of quartz ore on the 500 level which assays as high as $356. The extent will not be known for a week or ten days.——Work has been resumed on the Pittsburg-Nevada property, in the southeastern part of the Goldfield district.——Lee Garrett has sold his interest in the Goldfield Con. Mining & Leasing Co.'s lease on the Kendall. The purchasers are Vahrenkamp & Dorsey, who will put 30 men to work at once. The output is expected to reach 50 tons per day, and will be treated in the Bonnie Clare mill.——The production of the Goldfield mines for the week ending May 22 was 2439 tons, valued at $211,537.50. The Tonopah mines produced 6110 tons, estimated to be worth $120,000.

HUMBOLDT COUNTY.

The Standard group of six claims, adjoining the Eclipse on the west and north, has been purchased by J. M. Harman, who will at once develop the property.——The Michigan Co., operating on the Thor ground, between Seven Troughs and Mazuma, has ordered a 9-hp. pump to handle a large inflow of water at the 175-ft. level. They have been compelled to suspend operations pending the arrival of the pump.——A recently announced discovery of rich ore in the East Humboldt range has caused a rush of prospectors and investors. Tiptop, the centre of the excitement, is 12 miles southeast of Mill City, on the Southern Pacific.

LINCOLN COUNTY.

The Deeping Eldorado Gold Mining Co. has been incorporated to take over and work the Humphrey group of 17 claims, a mile north of the Wall Street mine, in Eldorado canyon. The property has several shafts, the deepest of which is 170 ft. The ore is said to be free-milling and bears considerable manganese.——The building of the Duplex cyanide plant at Searchlight was destroyed by fire last week. The loss also includes an assay outfit and $5000 worth of precipitates, 50% of which it is thought may finally be recovered. A good orebody has recently been uncovered at the 400 level of the Duplex mine, which it is claimed is 12 ft. wide and shows 2 ft. of shipping ore.——The new machinery for the smelter at Rich Hill, near Searchlight, has arrived and is being installed.

NYE COUNTY.

The West Extension, at Rhyolite, plans to sink a new shaft and make it the main working exit of the mine. It is reported that one foot of ore on the foot-wall of the south drift of the West Extension will average $5000 per ton.——It is reported that N. Paulsen, who is leasing on the Round Mountain Antelope property at Round Mountain, is planning to build a mill at once.

WHITE PINE COUNTY.

Regular shipments have begun from the Veteran mine of the Cumberland Ely to the big concentrator at McGill.—— Ore which it is claimed runs 75% lead has been uncovered at Duck creek, eight miles north of McGill.——Final payment of $10,000 has been made by S. A. James on the Rarus group of claims, southwest of Lane City. The property will be developed at once by means of a 100-ft. shaft.——The clearing of the Alpha shaft on the Giroux is completed and sinking has started. The shaft will be put down to the 1100 or 1200 level, at which point cross-cuts will be driven. The mill will be ready to start within the next 10 days. When completed it will use only the water pumped from the shafts of the company.——The Francis M. shaft of the Ely Bonanza Copper Co. was flooded with water last week to within 100 ft. of the surface.

NEW MEXICO.

SOCORRO COUNTY.

(Special Correspondence).—The Last Chance mine, at Mogollon, is maintaining its usual production of 60 tons per day, making it the largest producer of gold and silver in the Territory.——Cleaveland & Weatherhead are sinking the Deadwood shaft 200 ft. deeper, working three shifts and machine-drills. This property joins the Last Chance on the south, and its new orebodies seem to show that the Confidence Last Chance vein has frequent and regular orebodies for over a mile along the strike.

Mogollon, May 23.

UTAH.

JUAB COUNTY.

Work has been resumed at the Lower Mammoth mine. A small force is re-lining the shaft and repairing the machinery.——The repairs at the Raymond are completed and work will probably be resumed next week.——The McKinley management is receiving bids for the sinking of a 100-ft. incline shaft from the 400-ft. level.——Shipments of ore from the district amounted to 64 carloads for the week ending May 23, the shippers being as follows: Centennial Eureka, 52; Bullion Beck, 3; Eureka Hill, 4; May Day, 5.

SALT LAKE COUNTY.

The Butler Liberal Co. has resumed work at the Butler shaft and at the Jacobs Tunnel, employing three shifts at each.——The Boston Con. expects to increase shipments from the porphyry workings to 2000 tons per day. One thousand tons of porphyry and 300 of sulphide ore are now being shipped.——The Bingham-New Haven is changing its aerial tramway to the opposite side of the canyon. This change is made necessary because in the future the ore will be taken from the lower adit.

WASHINGTON.

FERRY COUNTY.

(Special Correspondence).—The Colville Mining & Smelting Co. expects to start its two rotary furnaces at Park City in a short time. These were taken in on sleighs last winter, and the work of installation is about completed. It is reported the company is buying another group of claims in the district.——The Mineral Hill Tunnel & Copper Mining Co. has driven an adit 1300 ft. long, from the face of which they expect to drive laterally about 700 ft. to strike the Minnehaha workings.——A vein has been encountered in the Handspike mine, on the north side of Umatilla gulch, in Keller district, which surpasses anything yet found on Tollaman Mtn. It is an east-west vein, 4 ft. wide, and assays over $50 per ton in gold, silver, and copper.——The No. 3 adit on the Copper King mine is in 581 ft. No ore appearing at the face, a raise, started 110 ft. back from it, revealed the foot-wall of the vein at 20 ft. above the roof. The raise was continued 7 ft. in solid hard iron-sulphide ore, bearing gold, silver, and copper. A statement was made that the vein is 50 to 60 ft. wide at that point, but there is no way of telling, or even estimating, the width at any point below the first level. In the raise the vein appears to be pitching very flat. The adit is being driven ahead to determine the pitch and strike.——The adit being driven at the Park City by the Colville Mining & Smelting Co. to intercept the Mountain Boy vein, is in 756 ft. It was expected the vein would be reached at 725 ft., but the formation (silicious limestone) has twisted from 40 to 50°, and it is now suspected that the vein has made an unexpected turn.——The Hercules tunnel has been driven 470 ft. and is now running parallel with the vein. A cross-cut from the face has penetrated the vein and some good ore well impregnated with chalcopyrite and galena has been developed. The cross-cut is being continued to ascertain the width of the vein.——The Department M. & M. Co. is planning to start work on an extensive scale on the Empire mine, in the Curlew district.——The B. C. Copper Co. is expected to resume work on the North Star and Washington claims about June 1, after a short period of idleness. ——The Railroad mine has several carloads of ore on the dump, which the company will ship as soon as arrangements can be made with the smelter people.

Republic, May 23.

STEVENS COUNTY.

(Special Correspondence).—The Robena M. & M. Co. has driven over 50 ft. of its lower adit and expects to drive about 400 ft. farther, to tap the vein at a depth of 162 ft. A quartz vein in the upper workings is 6 ft. wide and bears galena which may be concentrated to advantage. The second carload of ore is ready for shipment and will be sent to the Tacoma smelter.——A quantity of iron pipe and other supplies has been purchased for the Paymaster mine. Orders have been received from the company to push work as fast as possible, and unusual activity is expected.——In Metaline district the Calumet & Hecla Mining Co. has a group of eight claims which is traversed by two separate veins, about 800 ft. apart, that yield silver, lead, and zinc. There is a large quantity of ore on the dumps, and the stopes are sufficiently opened to run a 100 ton mill for some time. The company will erect a concentrator, much of the machinery for which is already on the ground. A saw-mill will be set up for cutting the lumber for the mill on the spot. ——The North Star mine, on First Thought hill, has let a contract for driving a 300 ft. adit.——At the Trophy mine a 200-ft. adit contract has just been completed.——The Silver Star mine, on Onion creek, in the Northport district, has lately uncovered an 8-ft. body of rich silver-lead ore.——The Spokane Lead Mines Co., at Metaline, expects to be concentrating ore in its mill early in June.——The Panhandle smelter is contracting for the richer lead ores of the Metaline district.

Metaline, May 23.

CANADA.

BRITISH COLUMBIA.

(Special Correspondence).—The western branch of the Canadian Mining Institute concluded its recent convention, at Rossland, with a visit to the mines of the camp. The managers of the large mines accompanied the party on its trip, and all members express themselves as well pleased with their stay in the Golden City.——The Jumbo mine will start development within a short time.——The shaft of the Centre Star, the heaviest shipper, is now down to the fifteenth level, 2100 ft. from the collar. Owing to the good showing, the shaft will be sunk still deeper. Rich ore is still being produced at the War Eagle.——A carload of ore was shipped out from the Blue Bird during the week. Work is being executed in the South Belt with some of the fervor and hope of old days. The Monday, near the Blue Bird, has been leased by John Brokenshire and associates, Mr. Brokenshire having sold his interest in the Blue Bird lease.——The business interests of the Boundary are in high spirits over the resumption of work by the B. C. Copper Co. and the anticipated starting up of the Snowshoe, with a faint hope that the Dominion Copper Co. may fall into line at an early date. Conditions are improving at the Copper company's properties, and before 30 days have passed they will be in a position to produce 2000 tons of ore per day and turn out over 1,500,000 lb. of blister copper. ——The plant of the Dominion company is being kept in readiness to start, but no such instructions have been received from headquarters.——The Crescent, in Skylark camp, shipped a 30-ton car to Trail smelter last week.——The plant of the Canada Zinc Smelting Co. will begin operations June 1. The capacity will be 20 tons per day. The plant is electrically operated and will consume 1000 hp., which will be furnished by the West Kootenay P. & L. Co. ——A rich strike has been made on the Granite-Poorman, near Nelson. The old vein has been uncovered and shows ore rich in gold.——A car of ore shipped from the Slocan Sovereign milled 90 oz. silver and 62% lead.——At the Giant mine, Golden, an up-to-date Elmore oil-process concentrator has been installed. This new-style plant will no doubt be more successful than the first machines were. ——It is the general opinion that the lead bounty will be extended, although nothing has been given out yet. One favorable feature for this continuation is that there is yet enough of the original grant unearned to run for six years, at the present rate.

Rossland, May 25.

MEXICO.

The Compañia Explotodora de Jalisco was organized on the 28th of April to explore and develop some 200-odd pertenencias in the State of Jalisco, of which 82 are in the heart of the Hostotipaquillo district.——The Mexican Mines-Prospects Co. has acquired a controlling interest in the Compañia Explotodora de Jalisco and the entire administration of the company has been placed in the hands of the management of the Mexican Mines-Prospects Co. Some prospecting work has already been done and a small tonnage of high-grade copper-silver ore has been extracted incidentally, but no attempts at extracting metal will be made until a thorough exploration of the properties demonstrates the best method of economically developing and extracting the ore.——The Real del Monte y Pachuca paid a dividend of practically ₱100 a share, aggregating ₱255,400, and the early payment of another large dividend is rumored. The new Guerrero mill has been placed in operation, which gives the company an additional daily capacity of 300 tons.—— New hoisting and pumping machinery has been ordered for the Buenaventura mine in the Sahuayacan district of Chihuahua.

Special Correspondence.

LONDON.

Aluminum Production and Prospects.—Troubles of Clitters United. —Great Boulder Proprietary.

The present low price of aluminum is causing the shareholders of English producing companies some uneasiness. For many years the price was not far from £150 per ton, and it was only in 1906-07 that the price boomed. During the winter of 1906-07 the average price was £200 per ton. Many people argued that the claims of aluminum were at last being recognized in the industrial world, and that the increased demand was due to the preference given to this metal over steel and copper. It was mortifying, therefore, to find that aluminum slumped with the rest of the metals during the summer and autumn of 1907; in fact, sunk proportionately more than its rivals. At the present time the price is between £80 and £90, and the producers admit that the demand is very slack. In some quarters it is stated that this slump in prices is not due solely to industrial inactivity, but to a policy of cutting inaugurated by the German and American producers, who desire to cripple the two English companies. The German and American producers have had the start of the English by a good many years. In fact, the English industry is only in its infancy. It is a plausible theory that the cut is intended to damage them just at the time when their installations on a large scale are approaching completion. On enquiry, however, I do not find any evidence of such a policy being pursued, and the directors of the English companies say that they are not aware of any competitive cuts. There is a general impression among people who are good judges that the days of high-priced aluminum are over, and that about £100 or £120 will be aimed at by producers as a maximum price. There is a rumor afloat in metallurgical circles to the effect that some producer has a process ready for active work whereby it is possible to use a cruder raw material; that is to say, that the refining is to be done after smelting, instead of before. If this be true, and I cannot say whether it is or not, the cost of production should be greatly reduced.

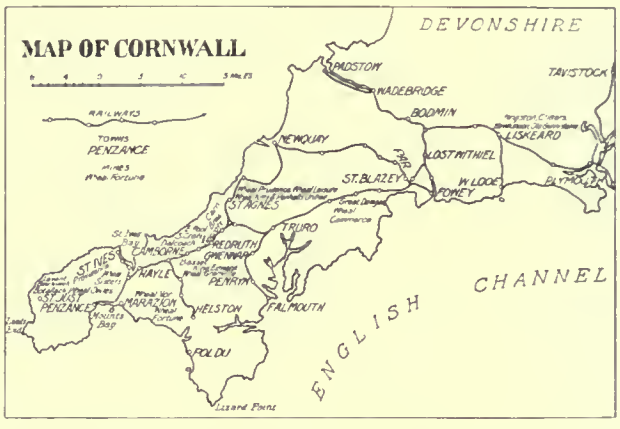
The two producers of aluminum in Great Britain are the British Aluminum Co. and the Aluminum Corporation. It is a Hibernianism to say that the latter is a producer, for their works are not yet completed; but let that pass. The British Aluminum Co. has been in existence for years. At the present time it is producing at Foyers and at a temporary plant at Kinlochleven, both in Scotland. The permanent works at Kinlochleven were to have been ready this year, but delay on the part of the contractors has occurred, and another year will elapse before they are completed. The company is also building works at Stangfjord, Norway, and Orsieres, Switzerland. When all are completed the total horsepower applied will be 70,000.

The other company, the Aluminum Corporation, is building works at Newcastle on Tyne, and in Carnarvonshire, Wales. The first named immediately adjoins the generating station of a big electric supply company which uses local coal. The Carnarvonshire works will be at first supplied by a local generating company, which makes use of the lakes on the side of Snowdon mountains, and whose current is largely used at the Welsh slate quarries. Eventually the Corporation will have a supply of power of its own, drawn from Lake Eigiau, in the same district.

None of the aluminum producers publish statistics of production, and any figures appearing in print are only guesses. For instance, the 'Mineral Industry' gives 2000 tons as the yearly output of the British Aluminum Co., and the London *Times* says 1500 tons. The yearly reports of the British Aluminum Co. do not give much detail. The gross profit for 1907 was £149,783, and the net profit £120,481. Out of this, £28,514 goes to debenture interest, £43,034 is payable on various preference and ordinary shares, £20,000 written off for depreciation, £8986 is used in redeeming some funding certificates, and £17,991 used in cancelling certain debentures. The profit for this year was rather less than in 1906, when the gross profit was £178,900.

In my letter published April 25 I mentioned that the Clitters United Mines, Cornwall, had passed out of the control of the Schiffs into that of the Allen-Meyerstein group, owing to financial difficulties which the latter undertook to remedy. Since then the expectations of relief have been found to be premature, and the expected funds have not been forthcoming. The debenture holders, in order to protect themselves, have forced a receivership upon the company. A scheme is now being formulated for reconstruction, whereby the present 118,826 shares of £1 each will be exchanged for a similar number of 10s. shares credited with 5s. paid in. Creditors of the company are to be offered shares in full satisfaction of their claims, and debenture holders will receive similar debentures in the new company. This failure of the Allen-Meyerstein group to find the money is regrettable, for it casts a shadow on some of the other commitments of the group. For instance, the South Crofty is to have its mills doubled, and before long Botallack will be wanting more money.

Another unfortunate incident in connection with Cornish mining is the closing down of Tywarnhaile. This is an



old copper mine between Camborne and St. Agnes, not far from the north coast of Cornwall, and it is notable among other things as having been the scene of early operations in connection with the Elmore oil process and the Elmore vacuum process. Three years ago the Consolidated Goldfields of South Africa, Ltd., put up some money for reopening the mine. Electric pumps, gas-power plant, and other modern appliances were provided, and the vacuum plant erected. With Professor S. H. Cox as chairman and consulting engineer of the company, and with Captain W. R. Thomas as manager, things looked hopeful enough, but last month Fischer Wilkinson, consulting engineer to the Consolidated Goldfields, rather unexpectedly advised his clients that the work should be abandoned. The mine is now being closed down, and the funds in hand, some £9000, will probably be distributed to the shareholders. Naturally Prof. Cox, Mr. Thomas, and Cornishmen generally, are in disagreement with Mr. Wilkinson. The difference of opinion centred chiefly around the method of mining, Mr. Wilkinson having no sympathy with the methods of mining commonly pursued in Cornwall. He argues that, with the altered conditions in Cornwall, operations should be conducted on a larger scale, and on modern lines. This is, of course, a matter of opinion, but my view is that if operations should be conducted on a larger scale, the operations should have been undertaken at Tywarnhaile, instead of closing the mine down. Pumping has only been effected to the 40-fathom level, and no ore of importance has been found. This was far too shallow work. It is not to be supposed that the old owners of the mine had left any valuable ore so near the surface. To have been of any value the pumping should have been completed to the bottom, and exploration work should have been started where the old miners left off. However, it is too late for

me to say anything now about Tywarnhaile, and instead I will recommend that the Consolidated Goldfields transfer the plant to Wheal Busy or Killifreth, two mines near Chacewater that would be well worth re-opening on a large scale.

Recent developments at the Great Boulder Proprietary go far toward proving that Hermann Landau's lament over the impoverishment of the Kalgoorlie deposits at depth has little basis of fact. Richard Hamilton, manager of the Proprietary, reports that at the 2200-ft. level driving has been done to the extent of 350 ft., and that the ore is unusually rich. Across 300 ft. the ore averages 29 dwt., and for 50 ft. it yields 5 oz. The vein is about 5 ft. wide, but at some places is as much as 12 ft. The ore now being developed at this level is not reckoned in the ore reserves, which are figured at 650,870 tons, down to the 2000-ft. level, with an average content of 17¼ dwt. The ore varies in value from 9 to 45 dwt., and Mr. Hamilton exercises a judicious selection to ensure economical treatment. During 1907 the total ore treated was 152,118 tons, and the extraction was valued at £564,274. The profit was £341,976, out of which £28,043 was paid as taxes, £45,000 placed to the depreciation fund, and £262,500 paid as dividend. The yield of gold during the last four years has been practically invariable in amount. The ore is a sulpho-telluride. It is dry-crushed and roasted, after which approximately two-fifths of the gold is extracted by amalgamation and three-fifths by cyanide. The plant has just been extended so that the amount of ore treated will shortly be increased to 15,000 tons.

KALGOORLIE, WESTERN AUSTRALIA.

Chamber of Mines Report.—Labor Costs. — Water Supply. — Great Boulder. — March Output.

The annual report of the Chamber of Mines is generally of much interest, as one is able to gauge from it how that body views the mining industry. The speech of the chairman, Mr. Hamilton of the Great Boulder, has caused much comment. Among other things his report says: "The present trend of legislation in both State and Commonwealth Parliaments is to make the lot of the employer of labor increasingly difficult, and much more work and responsibility will in future be cast on the Chamber and kindred associations formed for the protection of the employers' interests. The shrinkage in the gold output, and the drop in the value of the ore treated, have been prominent features in West Australian mining for the past four or five years. Since 1904 the value of the yield has decreased on an average by $1,626,375 per annum. The tonnage treated has gradually increased from 2,160,657 in 1903 to 3,007,043 in 1907. Mining in West Australia is getting down to a low-grade basis, and reminds us that unless working costs can be still further reduced we cannot hope to maintain employment for the number of men now working here, since many of the mines are reaching a point where there is little or no margin of profit. I am constrained, therefore, to sound a warning note against agitations for increased wages, which some of the unions are discussing at the present. When the working costs approximate closely to those in the more favored mining districts in the Eastern States, millions of tons of low-grade ore in this State can and will be profitably mined and treated; but may we hope to realize such a desideratum? Much has been done in this direction by mechanical and metallurgical improvements; further advance will be made in these matters; more might be done in bringing down the cost of transport, and in turn, of foodstuffs and general supplies, to enable a reduction in wages, and in salaries. This must be faced sooner or later; there is no inducement for the investment of capital in mining enterprises under such conditions as obtain. The average grade of ore throughout the State will not exceed $12. Recent developments in some of the Kalgoorlie mines indicate that the orebodies will live down to great depths, and assay values met with in the lower levels are more uniform than were those of the upper levels. The outlook for mining could be regarded as hopeful if more reasonable industrial conditions were possible of attainment. Much has been done in efforts to suppress gold-stealing, but the evil is hard to cure."

The last issue of the Chamber of Mines monthly publication contains a most interesting article on 'The Mines and the Water Supply,' showing to what extent the water scheme has benefited the Kalgoorlie field. Following are a few extracts: "As a factor in the great desideratum of the reduction in working costs, the Goldfields water supply has played no inconsiderable part. The mines and companies constituting the Mines Water Trust get water at $1.20 per 1000 gal., while previously their water cost $1.20 to $1.44 per 100 gal. It is estimated that on the whole the actual cash savings to the mines in the Water Trust during the four years that the agreement has been in existence has amounted to over $1,750,000. The benefits conferred by the water supply on the mining industry are admittedly very great, but it is quite certain, and ought to be as readily admitted, that the State in benefiting the mining industry has also reaped enormous benefits itself. We may safely say that were it not for the water supply, mining operations on the Kalgoorlie fields would now be conducted on a very much smaller scale than they are."

During the month there have been no startling developments in the mines. The last progress-reports of the Great Boulder and the Ivanhoe show satisfactory results in all parts. The Boulder Deep Levels, which gained no little notoriety a few years back on account of a swindle worked, had an encouraging strike at the 1100-ft. level, where 13 ft. of ore was cut worth $16.70 per ton, with another 9 ft. of lower grade. This mine is situated in a group at the extreme south end of the 'Golden Mile.' It is to be hoped that something of a permanent nature will be opened up in this direction. Having filled up practically all its area, the Kalgurli Co. is about to stop dumping its residue in the old style, and is preparing to pump the slime away as it comes from the filter-presses. The Cassel plant has been started on the Lake View Consols for the treatment of its huge residue dump. When this plant is in working order, a full description will be given in my regular correspondence. The following table presents a review of the economic results obtained in this district for the month of March:

Name of mine.	Tonnage.	Value of output.	Profit.	Dividend.
Associated	10,395	$108,000	$ 33,000	$
Associated Northern..	3,730	47,000	26,000	
Golden Horseshoe ...	23,484	250,000	100,000	
Great Boulder	13,848	230,000	125,000	
Great Fingall	22,023	175,000	65,000	155,000
Hainault	6,210	37,000	2,600	
Ivanhoe	19,645	210,000	105,000	450,000
Kalgurli	10,775	145,000	80,000	225,000
Kalgurli South	9,029	61,000	9,000	
Lake View Consols..	9,868	59,500	6,500	
Lancefield	6,692	47,000	*13,000	
Oroya-Brownhill	12,024	80,000	20,000	
Great Boulder Perseverance	17,035	126,000	33,000	
Sons of Gwalia	13,130	105,000	35,000	80,000

*Loss.

TORONTO, CANADA.

Elk Lake City. — Discoveries at Silver Centre. — New Plant at Cobalt. — Ore Shipments.

A great deal of machinery is being installed by the producing mines of the Cobalt camp. The Kerr Lake company has put in a Rand-Jenckes hoisting engine with a capacity of 3000 lb. The Nova Scotia has installed a Rand-Jenckes hoist. The Nipissing has ordered two hoisting engines with a capacity of 3500 lb. each. The Little Nipissing has put in a large hoist and an 8 by 12 winding-engine. The Silver Queen has installed a 12-drill Rand compressor and is putting in a 100-hp. boiler, which will be one of the most complete plants in the camp. The Coniagas is putting in a gas-

producer plant to furnish power for the concentrator. Shipments are steadily increasing. Last week, ending May 16, was a record one, with shipments from a dozen mines reaching a total of 447 tons. The following is the official record since January 1, stated in pounds:

	Week ending May 16.	Since January.
Buffalo	.....	563,810
Coniagas	.....	380,910
Cobalt Lake	65,845	246,455
Crown Reserve	.....	40,000
Cobalt Central	49,200	156,380
City of Cobalt	.....	338,600
Drummond	.....	92,340
Foster	.....	238,400
Kerr Lake	61,960	392,670
King Edward	.....	127,240
Larose	89,000	1,981,652
McKinley	60,000	1,243,900
Nipissing	133,020	1,316,920
Nova Scotia	106,765	227,565
Nancy Helen	.....	140,420
O'Brien	63,800	1,826,870
Right of Way	60,500	181,180
Provincial	.....	143,210
Standard	.....	39,730
Silver Queen	.....	524,200
Silver Cliff	.....	52,000
Silver Leaf	.....	132,800
Townsite	.....	85,100
Temiskaming & H. B.	60,000	599,000
Temiskaming	88,140	325,390
Tretheway	.....	679,916
Watts	66,000	180,430
Totals	895,230	12,304,448

Great activity is being manifested in connection with Cobalt camp and its extensions to the northwest and south, which, in the opinion of many, promises, on the completion

O'Brien Shaft, Cobalt.

of transportation facilities, to rival the original field of operations in the matter of shipments. The attention of prospectors of late has been largely directed toward Elk lake, on the Montreal river, and the new camp of Silver lake, situated in Mickle township, about 1½ miles west of James township. With the opening of navigation many prospectors and mining men have gone to these camps, and development work has been actively begun on a large number of claims. There are said to be in the Elk Lake district some 165 claims having good native silver showings. The Moose Horn mine, in James township, about a mile east of Elk Lake city, is the first property in the new district to be equipped with machinery. This mine has 10 tons of ore ready for shipment. The property embraces four 40-acre claims, all of which have passed inspection. A remarkable discovery was recently made at Elk Lake city in the course of excavation for a cellar at the Grand View hotel. At a depth of about 3 ft. a vein was struck, from which a nugget of silver weighing about 400 lb. was taken.

The formation and mineral indications of this district differ considerably from those of Cobalt. There are miles of diabase and conglomerate rock bearing well defined veins often running very close together, the presence of silver being generally indicated by a capping of specular iron. When this occurs, calcite and smaltite are usually found at a depth of a few feet, and a short distance farther down native silver is frequently discovered in good quantities. The known mineralized area of the Silver Lake district is rapidly extending. One of the most noted locations is that of Sam. Otisse, on the west side of the lake, where a dozen veins were discovered last fall on the outcrop, one of them being nearly solid silver and about 4 in. wide. Hubert and Bloom lakes, lying to the north and west of Silver lake respectively, also offer tempting opportunities for the prospector, and a large number of claims have been passed by the inspector on native-silver showings.

At Silver Centre, the name by which the new camp to the south of Lorraine township is now known, several new discoveries are reported, and many properties have changed hands. On the Mayhew property, adjoining that of the Haileybury Silver Mining Co., a 10-in. surface-vein of smaltite, niccolite, and native silver was discovered. The Haileybury Co. is steadily continuing development, and is sacking large quantities of ore. An assay office and a general store have been opened on Lake Temiskaming, and a post-office will shortly be established.

Dr. Robert Bell, assistant director of the Canadian Geological Survey and a member of the staff for over 40 years, has received notice of his superannuation, to take effect June 1. He will receive a superannuation allowance of $1950 per year during life.

CANANEA, MEXICO.

Greene-Cananea.—Work of Reconstruction.—Trial Run of Furnaces.—Mine Development.—Fundicion Smelter.

The Greene-Cananea Co. has at present about 1100 men on its pay-roll. The greater part of these men are employed at and around the smelter. Although the heavier part of the work of re-construction is completed, there is still much to be done, and it will be at least July before the plant is completed and ready for operating. C. A. Shelby, the superintendent of the smelter, expects to start up two furnaces within a month to try the new system. It is not expected, however, that these furnaces will be run continuously, but merely to thoroughly test the new system of handling the ore from the mixing-beds and feeding it directly into the furnaces from the steel bins. This will probably not mean a general re-opening of the camp. One of Mr. Shelby's objections to this trial is that it may be mistaken by the public for an official resumption of operations, which would bring a large number of men into camp looking for employment, while the fact is that already a sufficient force is employed to carry on any experiments that may be undertaken.

The eight new furnaces have been completed for some time. Work is still being done on the steel bins above the smelters, on the installation of the belt-conveyor which is to carry the ore from the mixing-beds to the bins, on the slag-haulage tracks, and on the addition to the power-house for a large condensing plant, together with considerable finishing up of work all around the plant. A good deal of railroad work has been done since the shut-down, which includes the completion of the track to the Duluth mine, double tracking above the concentrators to the Veta ore-bins, and considerable trestle and bridge-work. At the mines various improvements have been made in the older properties, the only active development being at the Duluth, which work continually meets with marked success. One of the head mine officials stated that there is enough ore proved up above the 200-ft. level in this mine to last for three years of production, with heavy extraction. The camp is in much better shape than is generally supposed. Practically all of the business houses are open. Real estate values were expected to drop very low after the shut-down, while in reality houses and lots can be purchased but very little cheaper than formerly.

The blowing-in of the new Douglas Copper Co.'s smelter at Fundicion, Sonora, May 17, marked an epoch in the development of the mining industry on the west coast of Mexico. Heretofore every pound of ore shipped from the Pacific slope had to bear the heavy expense of transportation to distant markets, first by pack or wagon-train from points difficult of access to the nearest deep-water port or to the railroad. If shipped from a port the ore either went around the peninsula of Lower California and north to San Francisco or Seattle, or it made the trip south around the Horn to Europe or New York. If shipped by rail, freight and the custom-house expenses, together with the inevitable shrinkage in the ore from losses on its hard ride and transfers on the way to inland smelters, meant tremendous charges and reduction of net profit. The new smelter affords to an extensive territory a near-by market for the output of its mines. The plant is located on the main line of the Cananea, Rio Yaqui & Pacific Ry., south from Guaymas, about midway between the Yaqui and Mayo rivers. This railroad, together with the Sonora railway, runs through a mineral country from Nogales, at the international boundary line, down into Sinaloa, with Guadalajara as its ultimate terminal. Feeders greatly increase the tributary zone. At Torres, on the Sonora railway, the branch line to Represo brings in the products from La Colorada and Minas Prietas as well as from the region to the east, even beyond the Yaqui river. Just north of Fundicion the rich Yaqui mining country is being penetrated by a branch line running up the river, and to the south the Alamos branch opens up that well known district. About 100 miles farther south the Kansas City, Mexico & Orient Ry. is crossed by the main line, that road affording an outlet from the rich Fuerte and Choix mining country. Ore originating on the Gulf of California or the mainland coast farther south finds a near-by port at Guaymas, on the Sonora railway, or at Topolobampo on the Orient railway, from either of which ports it can reach Fundicion by rail. The plant was contemplated originally only for smelting ores from the Douglas Copper Co.'s near-by mines, chief of which is the El Cobre, in which mine alone sufficient ore is blocked out to feed the smelter for five years at its present capacity.

As yet but the first unit of the plant has been built, of which the more important installations are as follows: Morrison suspension fire-box boilers of 250 hp. each, designed for work at 150-lb. pressure; tandem compound Bates blowing-engines, direct-connected to Root high-pressure blowers; Bates vertical cross-compound engines, direct-connected to Western Electric Co. generators supplying current for driving all machinery and pumps, for which direct current at 500 volts will be used, while lighting will be at 110 volts; a 44 by 160 in. Power & Mining Machinery Co. furnace with 15-ft. settlers; 11-ft. balloon-shaped dust-chamber connected at one end by 6-ft. down-takes with the furnaces and at the other end with a self-supporting steel stack 12-ft. diam. at the base and 8 ft. at top, with a total height of 177 ft.; Jeffrey steel-pan roller-bearing conveyors, which elevate the weighed charge to the feed-floor, discharging it into a steel bin at each side of the furnace.

A 36-in. gauge steam railway reaches all parts of the plant. The ore as received is unloaded directly from the railroad cars into the narrow-gauge cars standing alongside, the sample going to the sampling mill while the balance is hauled over an elevated track and dumped into bins. From these bins the ore is drawn off below into charge cars, when wanted for smelting, and dumped into the Jeffrey furnace conveyors mentioned above. Automatic sampling and a general elimination of hand labor throughout in the movement of material, electric transmission of power, and the employment of the latest improved designs everywhere, indicate the thoroughly modern character of the plant.

The negotiations for cessation of hostilities with the Yaquis which took place recently affected only a portion of the Indians engaged in the conflict. This guerilla warfare might have been terminated a long time ago but for collusion on the part of those who found in it continuous opportunity for graft. The story of this Sonora outrage would equal that of San Francisco's corruption.

BUTTE, MONTANA.

Butte & Superior.—Anaconda Smoke Suit.—Anaconda Copper Co.—East Butte.—Butte & Buxton.

The Butte & Superior election was almost entirely by proxies. F. Augustus Heinze, N. Willis Bumstead, George Wesley Davis, J. A. Coram, George H. Flint, Charles R. Leonard, C. F. W. Dillaway, M. Sellars Largey, C. D. Coram, E. L. White, S. S. Rosenstamm, John MacGinnis, and Henry Mueller were re-elected. The new directors are George H. Flint, H. M. Burton, and George Baglin. The election was the only matter that came before the meeting, and there was little opposition to the men put on the board, though a minority of stockholders had been organized in New York to protest against the management. This opposition is seeking to form a committee of stockholders to make a thorough investigation of the condition of the company's affairs. They are not satisfied with the close relations existing beween the vendors of the property and F. Augustus Heinze, and there is much complaint over the fact that it was represented to them that there was $2,000,000 cash in the treasury when only a small fraction of that sum was ever provided, while the vendors apparently met their contract with the company by depositing in the treasury 95,000 shares of stock at $15 per share, when it was selling on the market at $5 per share, and is now selling at $3. It also develops that all the contracts for the purchase of the property have not been met, and that there is still due the Daly estate $75,000. This was due last January, but an extension for six months was obtained. At a recent meeting of the directors in Boston, President J. A. Coram and F. A. Heinze, the latter being chairman of the executive committee, made statements that the company would soon be shipping 500 tons of ore daily, and that within three months the company would be on a self-supporting basis. In Butte that was known to be impossible, and if the company is in position to ship 500 tons per day a year hence it will be doing better than is expected of it.

W. B. Lowe, a geologist and mining engineer, who recently made an examination of the North Butte Extension property, has made a favorable report. He traced five veins and several strong spurs onto the property. Any one of four of these veins is, he says, sufficient to make a mine that will compare favorably with any in the district, and that copper will be produced at a less depth than that at which pay ore is reached in the average mine in Butte. Two lines of railroad are easily accessible from two points on the property. Geographically the claims are advantageously located. The Butte & Superior Co. has cross-cut the Blackrock vein at a depth of 1000 ft. The vein is about 60 ft. wide and carries much ore, mostly zinc, which can not be treated in this part of the country. There is talk of mining the ore and shipping it to Kansas City to be treated for zinc and silver. It is claimed that the ore will return net about $22 per ton. The vein will be explored at that depth and sinking will also be continued until the shaft reaches 1200 ft. It is now 1080 ft. deep. So many 'strikes' have been reported by the Butte & Superior that there is always some suspicion attached to news from that quarter, but assays show 41% zinc in the ore on the 1000-ft. level, a small percentage of copper and about 25 oz. silver to the ton. The Butte & Superior authorized the issuance of $500,000 in first mortgage bonds in order to raise money with which to carry on development work and to pay for the property. The bonds can not have found a ready market, for the final payments on parts of the property have several times been extended, and will fall due again next month. The Raven Mining Co. has cut the Raven vein from the 1000-ft. station of the incline shaft. The vein is 26 ft. wide, the ore assaying 2% copper, with some silver and gold.

The final arguments in the Federal Court on the smoke injunction case, in which the Deer Lodge valley farmers are suing to close the big Washoe smelter of the Amalgamated Copper Co. at Anaconda, will begin May 26, before Judge Hunt in Helena. Each side will argue 10 days, and the findings of the Master in Chancery will then be taken

under advisement by the Court. A decision may be expected some time in the fall.

The annual report of the Anaconda Copper Mining Co. for the year ending December 31, 1907, contains some interesting information relative to the operations during the year. President John D. Ryan says that because of the high price of copper early in the year it was deemed advisable to treat ores of a lower grade than had been extracted in any previous period in the company's history. Much of the product from the treatment of the low-grade ores was not marketed until late in the year, some product of ores mined as early as March not being sold until the latter part of the year, at prices 10c. to 12c. per lb. lower than were ruling at the time when the ore was extracted. The copper on hand at the end of the year was produced during the period of curtailment, and cost the company $163,105 more than was realized from its sale. During that period the output of the company was as low as 35% of the normal, and finally production was stopped completely, at the beginning of December. The mines were re-opened March 1, and by the latter part of that month the production had about reached the normal. By the first of May the production-figures showed a considerably higher grade of ore and lower cost per pound of copper than have been realized at any time in years. The veins in the Anaconda mine had been opened on the 2200 and 2400-ft. levels; on the 2000 of the St. Lawrence and 2200 of the Neversweat, but practically no stoping was done on them until mining was resumed in March. A new vein yielding a good concentrating grade of ore has been found in the upper levels of the St. Lawrence, and has been opened a distance of 500 ft. in length. The south vein of the Anaconda group has also been opened on three levels, and half of it is smelting ore. The Washoe smelter treated for all companies last year 2,582,611 dry tons of ore and other copper-bearing material, including 1,110,203 tons of ore from the mines, 2966 tons of concentrate, 16,250 tons of slime, and 24,226 tons of slag from the old smelter. There was produced 63,055,661 lb. fine copper, 2,001,350 oz. silver, and 8290 oz. gold. The gross earnings of the company were $18,751,133, and the profit was $3,378,220. The surplus at the end of the year was $9,183,241. The value of the copper, silver, and gold on hand, taking account of the loss on copper, was $6,002,643.

That the Amalgamated Copper Co. has no thought of curtailing production, but on the contrary is gradually increasing its output of copper, is evidenced by the fact that two more mines have been added to the list of producers, work having been resumed on the Neversweat of the Anaconda Co. and the Gray Rock of the Butte & Boston Co. The Neversweat was closed at the time of the general shut-down of mines in the Butte district last fall, and operations were not resumed at the time of the general resumption in March because the shaft of the mine was being re-timbered and repairs were being made to the hoist. The Neversweat employs about 200 men and its output is about 300 tons of ore per day. The Neversweat is a rich mine and is on the same veins as those on which the Anaconda mine is working.

Work is being done preliminary to a resumption of operations by the East Butte Copper Mining Co., which owns a number of small mines and some immensely rich ground just south of the Pennsylvania mine, the richest of the Boston & Montana properties. The East Butte has 12 shafts on its ground, all but two of them having been used by lessees. The two main shafts, No. 1 and 11, are situated at the extreme north and south ends of the company's ground, and are being connected by cross-cuts. Shaft No. 1 is 900 ft. deep and is probably the best-built three-compartment shaft in the Butte district. No. 11 is nearly 500 ft. deep. There are some 20 known veins in the East Butte ground, striking east and west, the largest of which is about 80 ft. wide. A body of copper glance was cut in the shaft near the 900-ft. level at the time work was stopped last fall, when the Washoe smelter and the Amalgamated mines closed on account of the unsatisfactory condition of the copper market. Frank M. Sullivan, Patrick Wall, Henry Mueller, William A. Paine, and other stockholders of the company have personally advanced funds necessary to carry on and complete the development planned last year for bringing the mines to a producing and dividend-paying stage. The plans include sinking the two main shafts to a depth of 1500 ft. and cross-cutting every 200 ft. William Clancy, the company's mining engineer, made measurements of the ore in sight last fall above the 400-ft. level, and placed the amount at 1,000,000 tons.

The Butte & Buxton Copper Mining Co. has been incorporated for the purpose of developing the Lackner properties in the Summit Mountain district, 10 miles southwest of Butte and two miles from Buxton station, on the Oregon Short Line. Recent developments show an orebody 10 ft. wide, the lead itself being from 60 to 100 ft. wide. Five feet of the ore is claimed to assay 4 to 8% copper, 10 to 20 oz. silver to the ton, 10 to 20% lead, with about 40c. in gold to the ton.

SALT LAKE, UTAH.

Smelting Conditions. — Utah Smelting Co. — Boston Consolidated.

The past week has wrought a perceptible improvement in the mining and smelting situation in and around Salt Lake. Authoritative information to the effect that the United States Smelting, Refining & Mining Co. would positively resume the purchase of custom lead ores by the middle of June has been received with much satisfaction by ore producers; while the opening of the ore-purchasing department of the Tintic Smelting Co. for business has been hailed with equal gratification; thus bringing a return of old-time competition in the local market for lead ores. At this time the Garfield smelter of the American Smelting & Refining Co. is the only place where copper ores can be sent for treatment within the State of Utah; but this company has all it can do to take care of the contracts it already has on hand. In fact, it has not had furnace capacity to treat all the ore received, and the result is congestion to the extent that the smelter management has experienced much inconvenience of late. The bins at the smelter are filled, while many thousands of tons of ore have been unloadded from the cars in which it was brought from the mines and piled up in the yards, awaiting disposition later. Three blast-furnaces are in commission and the fourth is to be started up before the end of the month. Definite decision has been reached to place the smelter of the Utah Smelting Co., near Ogden, and which has been leased to a local syndicate, in commission again. It is said that sufficient contracts have been obtained to warrant doubling the present furnace capacity, and in all probability the plan to add converters will soon be carried out. No steps have been taken as yet toward making application to the Federal Court for a resumption of the copper smelter of the United States company, nor will any such move be made at once. However, the management is considering the erection of a sulphuric acid plant.

The American Smelting & Refining Co.'s lead smelter at Murray is running on low tonnage, only three furnaces being in service, and the monthly payroll is reduced to $20,000. The American has no contracts with the large lead producers of Utah; some ore is coming from Park City, a few small Tintic mines are contributing, but other than that the Murray plant is getting very little ore from Utah camps.

It is expected that the third blast-furnace at the Yampa smelter, in Bingham, will be ready for commission within ten days, and work is progressing satisfactorily with the installation of the converter department, which is being done at an expense to the company of about $80,000. The Yampa smelter is now treating an average of 800 tons of ore per day, but it will have equipment to treat 1000 tons per day by July 1.

The fourth unit of the concentrating mill of the Boston Consolidated Mining Co., at Garfield, is in operation. Each unit is intended to treat 200 tons of ore per day. The company is shipping 300 tons daily from the sulphide end of the mine, direct to the smelter.

Concentrates.

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

Paint will adhere to zinc if the latter be first coated with the following wash: Dissolve 1 part each of nitrate of copper and sal ammoniac in 64 parts of water to which add 1 part of commercial hydrochloric acid. Such a wash requires 12 to 24 hours to dry.

Silication is the union of silica (SiO_2) with a base to form silicates. This action must not be confounded with silicification, which involves the addition of silica to a rock without union with bases. Silicification, however, may take place by complete substitution of quartz in the room of another mineral which passes away in solution. This process results in making a pseudomorph.

In marking mining locations on the ground, a substantial compliance with the State law is all that is required, with reference to the character of posts. We do not think that the Courts would deprive a bona fide locator of his claim simply because his posts, which should be 4 inches square, are only 2¾ inches. They would hardly uphold a hostile re-location of the claim made on the sole ground that the posts of the original location were too small by one and one-fourth inches.

A mill-site may be acquired disconnected from the ownership of a mining claim. If a mill is erected on the mill-site, the unpatented title vests, and cannot be defeated by re-location simply because mining claims from which ores were reduced in the mill are subsequently abandoned. Even if the mill-site is an adjunct of a located lode-claim, if a mill is erected thereon we do not think that upon the abandonment of the lode-claim a re-locator could re-locate the mill-site and take the mill.

Lime is added to cement mortar for economy, and physical tests show that in quantities less than 15% the cost of the mortar is reduced more rapidly than the indicated strength, and is therefore economical. But addition of lime is equivalent to over-liming in the manufacture of cement, developing the fatal defect of gradual disintegration. This would seem to be due to the carbonation of the lime, causing expansion, which breaks up the imbrication of the crystals, which is what constitutes the 'set' on which the strength of the cement depends.

Ore deposits formed by aqueous agencies constitute certainly 99% of all those the origin of which has been demonstrated. Of these, according to Charles R. Van Hise, more than 95% are due to meteoric waters, but in the last few years there has been a growing tendency among geologists to attribute a larger number of ore deposits to the action of magmatic waters. These are waters originally present in the deep-seated voleanic rocks, which are forced out when solidifieation of the fused mass occurs. This solidifieation may be likened to the setting of cement.

Metallic tantalum, which has lately been widely used for filaments of incandescent electric lamps, has been known for a century, but isolated in pure form only as recently as 1903, when Moissan reduced it in the electric furnace. The most commonly occurring tantalum minerals are tantalite and columbite, which consist of tantalates and niobates of iron and manganese in varying proportions. In the United States these minerals are most abundant in the Black Hills, South Dakota, and also occur in small quantities in Connecticut and North Carolina. Tantalite is rich in the metal and contains about 84% of tantalum pentoxide, while columbite contains but little tantalum and is mainly composed of the practically worthless and often detrimental niobic pentoxide. The minerals are marketed on the basis of the content of tantalic acid (Ta_2O_5). The limited market is now overstocked, and it would probably be difficult to dispose of any of these minerals at present.

For assessment work on mining claims, structures placed upon the claim in good faith for the obvious purpose of developing the mine are considered improvements within the meaning of the law. Hoisting-works would be so regarded, but a boarding-house for miners would not be considered a fixture. This is based upon judicial decisions and common sense, and the rule obtains in all the mining States and Territories. In Montana the Courts had to deal with a peripatetic house which did service on one claim as improvements for patent purposes, and was thereafter moved and similarly used on a number of other claims in the district. Portable engines have been overworked in the same way. A gasoline engine and a hoist might be considered improvements on a claim, if erected and operated for the purpose of mine development. It depends to a large degree upon the question of good faith.

Silver sulphides in the upper oxidizing zone are rapidly converted into sulphate, which is readily soluble. In this form it would be leached downward until it should mingle with a solution of ferrous sulphate, when the silver might be re-precipitated as sulphide, as shown by the reaction,

$$Ag_2SO_4+12FeSO_4+12H_2O=Ag_2S+4Fe_3O_4+12H_2SO_4$$

or a reduction to native silver might occur under the same circumstances, as follows:

$$Ag_2SO_4+3FeSO_4+4H_2O=2Ag+Fe_3O_4+4H_2SO_4.$$

Organic matter, which is always present in the waters near the surface, will likewise reduce the silver to the metallic state, but the presence of chlorides such as those of sodium and magnesium, which are never entirely absent, and in some desert regions particularly abundant, will effect precipitation of the silver chloride appearing as horn silver. It is evident that silver, being so readily precipitable from solution by reagents which are sure to be available near the surface, cannot travel to such depths as copper, and hence we observe a tendency to relatively superficial secondary enrichments in silver veins, while if copper had been present the secondary ores of that metal will be found more abundantly at a lower level below the silver.

Discussion.

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy.

Mining Law.

The Editor:

Sir—It is pleasurable to observe that Mr. Charles H. Shamel insists upon further discussion of the 'apex question' and the extra-lateral right conceded by United States statute to the locators of quartz-mining claims. It is frank confession that he recognizes reserve ammunition still in the possession of the besieging forces. I may acknowledge that I entered the lists on the invitation of the editor of *Economic Geology* not as a radical, insistent upon sweeping away the old law, but as an apologist for the Congress, which had been cudgeled unceremoniously by Mr. Purington. My main point was to ascertain why our body of legislators should have framed a mining statute so little consistent with geologic conditions, and the reason was found to lie in simple unconsciousness of the truth, or of the existence of any means for reaching the truth, about the characteristics of ore deposits. The statutes of 1866 and of 1872 were drawn, debated, and enacted into law, without consultation with or advice from a single educated experienced geologist, and the arguments in favor of the law were bolstered up by reference to miners' rules in California and Nevada, and by letters from uninformed mine operators in other western States and Territories. The gentlemen from Nevada, California, and Oregon distinctly 'had the floor' in that debate, and the only obstinate party who 'wanted to be shown' was not from Missouri, but from Ohio. Senator Sherman was sincere in his effort to provide a wise statute, having come to the conviction, in divergence from all precedent in the land of common-law origin, that mineral veins on Government land should be granted in fee-simple, and if anyone had hinted that there really was anybody who knew more about veins than Senator Stewart, that person certainly would have been consulted by the Senator from the 'Buckeye State.' It was a singular case, as if the Congress should alter the tariff on steel upon representations of the state of industry made by laborers in the works, instead of taking evidence from the consulting metallurgists, and especially from the officers of the corporation—an error which is unthinkable as regards any politician, past or present. But California and its gold had hypnotized the world, and the treasures of the Comstock had dazzled it, until the mention of a mine transported the thoughts far away to regions of romance. There is no doubt about all this. Let anyone read the congressional debates, and note the awestruck deference of the other members when the spokesman for the western miners rises to explain and demand *amparo*. Congress simply forgot all about the iron mines of New Jersey, of Pennsylvania, and New York, the copper mines of Michigan, the lead mines of Illinois and Missouri, and the fruitful lessons that might have been deduced from them. It forgot how many centuries ago Agricola had written wiser and sounder facts concerning ore deposits than any adduced by the representatives of California and Nevada in our national assembly. It overlooked the long experience of England and France and Germany in establishing equitable bases for ownership and exploitation of minerals, whether in veins or deposits of other form. The marvel is that the blunders were not more serious than they have proved in practice. Perhaps no more striking case of departure from the spirit and essence of common-law development could be found than this instance of crystallizing into a statute some of the local regulations of a small group of men, who had accidentally adopted a principle at variance with the customs of all nations and all ages, who had experimented with it, litigated more or less about it, and had spilled a great deal of blood over it, for a trifling period of sixteen years! Common law is the ripened fruit of ancient custom, with the bitter principle mollified by the beneficent sunlight of experience. It represents the way men have found to lead away from disputes, not into a bristling wilderness of contention.

Mr. Shamel must excuse my invasion of his territory of the law, since he chose to invade that of the geologist. We can both stand more firmly on our own proper ground, no doubt. The geological difficulties in the case have of course been accommodated by the concurrent growth of case-law, the dear delight of the attorney and the despair of the layman! The result is decisions by the thousands, lying as adverse and confused as the sticks in a crow's nest. Decisions can be cited pro and con to sustain any interpretation of the statute, but except where a Supreme Court decision has been handed down no honest lawyer can say to his client the 'law' is thus and so. The 'law' in California will be unlike the law in Colorado, according as the Supreme Courts of the respective States may have decided on the State laws based upon the Federal statute, unless the point has been reviewed by the United States Supreme Court. But no man need ask his attorney what belongs to him when he holds title to land whose limits are within planes extending vertically downward around the sides. The old miners in California had a feeling that an original discoverer of a vein was entitled to exceptional reward. Governments everywhere concede the same in protecting human ingenuity in the arts, but it is noticeable that the patentee's rights do not extend to all the dips, spurs, and angles that may subtend from the original happy thought, from the mere apex of invention. He has no exclusive right to a new principle wherever it may lead. He can not obtain patent to the principle itself, but only to some specific application, to some defined method for the beneficiation of the principle. He has no extra-lateral rights. If there were any justification for making broad concessions of right to discoverers it would seem to be in the case of patents, protecting a man in the enjoyment of the fruit of his initiative, which is a necessary stimulant to progress and civilization. But the law tacitly affirms that a man may

not lock up the powers of nature from his fellowmen; that whether he will or no he must be something of an altruist, not an unsocial creature. But intense assertion of individualism is characteristic of frontier communities, where the dominance of a few strong spirits is more absolute than that of oil-kings and steel-magnates, and this excessive demand for all that might follow from a discovery of outcropping mineral reflects the spirit of the times, with its maddening race for wealth, that was made in the primitive fashion suggesting Homeric and Virgilian story. Those old booted and belted Argonauts originally claimed in a vague sort of way as much ground on each side of a lode as might be necessary to protect control of the vein, no matter how far its dip might carry it. Here was clearly the mingling of the mental streams of apical greed, and of ancient restraint through recognition of the bounding planes that divided one from his neighbor. Presently there came the greed that would rise as well as descend in its quest beyond its natural borders, so we find as early as 1855 in the 'quartz mining law' passed by the Angels mining district, in Calaveras county, California, an article affirming that "he or they shall have the right to all dips, spurs, or angles of every vein originating on the claim. We understand that a vein originates on or below the surface, running downward, and not from below running upward, so that no person or persons locating a claim on either side of the boundaries of another shall have a right to a vein running through his or their claim that originates as above understood on the claim first located, but no man shall have the right to follow a vein on the length of it beyond the perpendicular line of his boundary." The question of a tunnel-locator's right under the law—in forgetfulness of that old Calaveras pronunciamento—and the privilege it may confer of getting under another fellow and raising him out of his property supposedly acquired through location on an apex, is one that to this day is not decided, nor does anyone know of a certainty what extra-lateral rights may pertain to a tunnel-discovery of a vein, in either direction.

The fundamental mining law of the United States was built upon inchoate regulations obtaining in a limited area, where the type of veins encountered had been almost wholly simple in structure, as evinced by the terms of the law itself. The demand that an apex be discovered, and the conceded right to follow the vein on its dips, spurs, and angles, expresses a conception which by no possibility could embrace such ore occurrences as those which have made the fame of Rico and Leadville, of Bisbee and Keswick, a conception which can be made to apply only through that necessity for stretching language to its elastic limit, which is imposed upon the judge when the law-maker legislates without precautionary information upon the elements of the principles involved.

The problems of cross-veins, branch veins, overlapping veins, associated but discontinuous masses, irregular masses with apices instead of a single apex—these in mere catalogue raise spectres of evil when one considers the Federal prescription for making a mining title sound. The judges have been working for forty years to explain what the law meant to say, or should have said, but did not, and perhaps in time enough cases will have been adjudicated to admit of codifying the case-law so that an ordinarily intelligent student may know with some degree of certainty what his rights under a particular set of circumstances might be. Until that time may Mr. Shamel have joy of the litigation in which he will reap well-earned rewards for patient guidance of his clients, unless he choose to turn public benefactor and help to blaze out a safe trail for a new law that may save future mine-owners from trouble without infraction of any existing rights arising by virtue of the act of 1872.

San Francisco, May 25. COURTENAY DE KALB.

Valuation of Mining Shares.

The Editor:

Sir—In determining the value, from a non-speculative standpoint of mining stock, the redemption of capital is too often ignored. Investors are frequently misled by promises of seemingly high rates of interest extending over the life of the mine, which rates, viewed in the light of 'money back,' shrink away. What appears on the face a profitable investment ultimately turns out to be a loss or returns at the best a low rate of interest. In other words, unless the value of an investment is properly calculated, the yearly dividends prove to be not profits at all, but merely the redemption of the principal. Given the life of a mine and its yearly dividends, what is the present value of its shares? The investor should expect a certain annual rate of interest for his capital, varying from 6 to 15%, in addition to the return of the capital invested at the end of the life of the mine, his sinking fund in the meantime being invested at 3%. The annual rate of interest expected varies, of course, with those factors which make up the risk, factors such as locality, climate, kind of metal mined, labor conditions, transportation, and so forth. One should be satisfied with a much lower rate of interest in Oroville (California) shares, for instance, than in the shares of a mine in Korea or Borneo. In the former case, 7 to 8% and money back would be not unreasonable, whereas 15 to even 20% should be demanded from the latter. I wish especially to insist that the rate of amortization should be assumed at 3%—the safe bank rate. Sometimes in England the rate of amortization is assumed equal to the interest received; that is, apparently the sinking fund is supposed to be reinvested in the shares in question. This appears to me unsafe. A well known mining handbook published in London gives a list of factors for determining the value of mining stock. These factors are misleading, as they assume that the capital is amortized at the same rate as the interest expected; that is, if one receives 10% on his investment, his sinking fund is to be invested at 10% in order to redeem his capital. This is a manifest error, and the results over-value the mine.

The total interest required in order to return a

certain rate of interest per year, and amortized at 3%, may be estimated as follows: Shares in a mine with two years' life must return to the buyer $56.26 per year for every $100 invested in order to pay 7% per annum and amortize at 3%. Of this, $49.26 must be invested at 3% to redeem capital, the remainder being 7% on capital. The present value of the shares is $88.87 for every $100 of net ore in reserve. If the mine has a 10-year life, the shares must pay 12.38% in order to obtain 7% per annum and amortize at 3%. Here 5.38% of the gross interest must be banked each year toward redemption of principal. The present value of these shares is 63.59% of total net profits. If the life of the mine be 20 years, under the same conditions, the gross interest must be 10.72%, of which 3.72% is the sinking fund. These shares are worth today only 46.635% of the total net profits. Here is an example. Assume a placer mine with a proved net profit of $50,000,000; life of mine, 20 years; capitalization, 5,000,000 shares at $5 par value, or $25,000,000. Our friend the promoter would exclaim: "Here are two bright new dollars for each old one!" or, as we have all recently read in a maze of financial and termological inexactitudes, "Gold for sale! 50 cents on the dollar!"

First. If these shares are purchased at par ($5), what rate of interest per year would they return to buyer in addition to money back, amortizing at 3%? The mine pays $2,500,000 per year, or 10% gross interest on investment. For a 20-year investment a gross interest of 9.72% (nearly 10%) will give money back (3% amortizing) and return in addition 6% only on investment. So this stock at par value will only yield 6% on investment and money back. Of the $2,500,000 per year, $1,000,000 must be invested each year at 3% for redemption of capital: the other $1,500,000 is the 6% profit on investment. Figure it another way: The factor for the present value of a mine with a 20-year life, amortization at 3%, and yearly dividends at 6%, is 51% of total profits. In this case 51% of $50,000,000 is $25,500,000, which is about the capital assumed. Hence a capitalization of $25,000,000 yields 6 per cent.

Second. What are the shares in this mine actually worth today, in order to return to the investor 10% interest and amortize at 3%, the dividend being the same as $2,500,000 per year? To return 10% and money back the mine should yield a gross interest of 13.72% per annum for 20 years. Hence the real capitalization should be $18,000,000, that is, the shares are actually worth $3.80 each. Bought at this price and investing sinking fund (in this case $7 out of every hundred of the dividend) at 3%, the shareholder will have received during the life of the mine 10% on investment and have had his money returned. It has been recently pointed out* that of the large number of Rand mines only two of them stand up under the test of a fair return for capital invested (in this case 8%) and money back.

The 'profits' of most are not profits in the above sense of the word, the dividends paid being the repayment of capital and in some cases an additional small rate of interest. To bring this fact home to the shareholder the author of the paper referred to has well suggested that redemption of all capital invested should be in the future added to the costs per ton of ore treated. If this be done it will show at a glance whether the profits be real or imaginary. It will also tend to keep down capital expenditure and to check in a measure the deferred payments of dividends.

To enter another field, apply this method to one of the dredging cost-sheets. Assume 300 acres of dredging ground to cost $300,000, and equipment of ground $150,000; operations to extend over 12 years; interest at 12% per annum; capital redeemed at 3%; one dredge treating 1,000,000 cu. yd. per year.

A cost-sheet including redemption of capital would appear thus:

	Per cu. yd.
Redemption of cost of ground	5.715c.
Redemption of cost of equipment	2.752c.
Working cost	7.000c.
Total	15,467c.

The first two figures (8.467c.) are, of course, dividends, and by their distribution annually the investment will pay 12% in addition to money back. The ground must yield 15.467c. per cubic yard to meet these conditions. If its yield be under this amount, the shares will pay less than 12% net interest. If it be over, the excess can be used as extra dividends or toward a special fund for the purchase of additional acreage or equipment.

I quite realize the limitations of the method of valuing property herein set forth. It can only be applied to those mines paying a definite profit extending over a known life. Such cases are not uncommon, but the data required are frequently difficult to obtain. The mines of the Rand afford a well known example. To many alluvial gold mining enterprises the test can also be applied. Where, however, the value of a property is wholly prospective or speculative, other methods of valuation must be employed. I also confess that I have, in a measure, been threshing over old straw.

These 'money back' calculations should be applied to all legitimate stocks, yet it is surprising to find among shareholders (whose all is invested in mining) how few of them really can and do rightly determine the true value of their holdings. If these people could be brought to view a mine as an annuity having a given life, and if they realized that their dividends are not all 'velvet,' running on forever, much worthless stock would remain unsold, and mining investments among this class would not eventually be so bitterly condemned.

NEWTON B. KNOX.

London, April 6.

*In a pamphlet on actual earning power of Rand mines by George A. Denny, London.

Cyanidation of Ore Containing Both Coarse and Fine Gold.

The Editor:

Sir—The numerous responses from well known authorities on ore treatment to my letter published on December 7 last over the signature of 'Viator,' encourages me to seek the hospitality of your columns in order to offer a few comments upon the

divergent suggestions made, and at the same time to express my thanks for the light which has been thrown upon the subject.

The broad form of query, to which you invited replies, has elicited a good deal of support for the method of crushing in water when the ore contains a considerable proportion of amalgamable gold, with subsequent treatment of the tailing only by cyanide. As pointed out by one contributor, the importance and efficiency of our amalgamation recovery has caused this system to remain common practice in South Africa. Those who advocate crushing ores of the class referred to, in cyanide solution, recommend the following methods for recovering the coarser gold:

(a) Use of amalgamated copper plates; their gradual dissolving to be regarded as an inevitable item of maintenance. No one, however, has dealt with the question of the copper from this source deposited in the zinc-boxes and its effect upon the clean-up.

(b) Use of spitzkasten for reducing the volume of pulp, to be subsequently ground and amalgamated in pans or similar apparatus. This method, of concentration before amalgamation, is hardly likely to afford as high an amalgamation recovery as when the whole pulp is amalagamated, since a very exact and constant regulation of the spitzkasten must obtain in order to prevent amalgamable gold, which cannot dissolve in a practicable time in cyanide solution, passing into the overflow. This difficulty also affects the recommendation of all-sliming the ore, and also presumably the gold, apart from the needless expenditure the latter course would necessitate in many cases, where sliming is not needed to expose the values thoroughly.

(c) Use of riffles for recovering the coarser gold. This method seems even less efficient than (b), and the re-working of placer sites, as at Oroville, shows how liable metallic gold of appreciable size is to escape this imitation of Nature's concentration methods. As in the previous suggestion, the high specific gravity of gold is alone relied on for its separation from a relatively deep stream of pulp, as compared with the combined effect of specific gravity and chemical affinity when the pulp flows in a broad shallow stream over an amalgamated plate. In applying both methods (b) and (c) to crushed ore after cyanide treatment there may be loss of particles of gold, whose original size was sufficient to ensure their recovery, but which by partial dissolution have been sufficiently reduced to be carried over in suspension in the pulp.

(d) Use of blanketings. No doubt, in the absence of more perfect and expensive concentrators, this device has very real merit in recovering tarnished or rusty gold, such as, even though fairly coarse, is not readily amalgamable either in a water or cyanide pulp.

(e) Only one reply deals with an expected suggestion of converting the amalgamated plate into a cathode, thus obviating solution of copper and mercury, while retaining the advantages of contact between brightened amalgamated surfaces and gold particles. Molloy's hydrogen amalgamator is based on this principle, but an even earlier suggestion, before the use of the cyanide process, is contained in a series of articles on gold milling by C. H. Aaron, appearing originally in the MINING AND SCIENTIFIC PRESS, re-published later in the *Gold Fields News*, Barberton, Transvaal, in October, 1890. This author says: "I recommend that millmen who have trouble with their plates should make some experiments, each separately, as follows:

"1. Place some bars of iron on the apron, say one across the upper end, and one on each side edge, also one in the middle.

"2. Use zinc amalgam on the apron.

"3. Dissolve a little cadmium in the quicksilver for use on the apron and in the mortar.

"4. Fix a tank so as to deliver a small stream of water, containing potassium cyanide, into the mortar constantly while crushing. (This has been done in some mills with good effect.)

"Those who have occasion to work auriferous material in pans would do well to try a solution of potassium cyanide in which a little red oxide of mercury is dissolved: the effect of this solution is to coat every particle of gold with quicksilver, which greatly aids the amalgamation. Not too much of the solution must be used, as it dissolves gold; however, it is believed that the dissolved gold can be recovered by using zinc amalgam in the pan toward the end of the operation. Before adding the solution, the pulp should be made slightly alkaline by the addition of a little potash or soda. It is believed by many that zinc amalgam is very effective in catching gold, and still greater efficieney is claimed for cadmium amalgam. The presence of zinc blende in the ore has probably a favorable effect on amalgamation by tending to prevent oxidation of the plates, with which it forms a galvanic couple in the same way as does a piece of zinc."

W. A. CALDECOTT.

Johannesburg, Transvaal, March 23.

An acid-vapor rust-proof coating may be applied to metallic tools and other articles by the following method: Prepare a sheet-iron box provided with a false bottom of wire netting. Put a layer of crushed blacksmith's coal, about $\frac{1}{3}$-in. deep, onto the sheet-iron bottom of the box, put the articles to be coated (which must be entirely free from grease and rust) on the wire net. Close the box tightly and heat over a quick fire until the bottom is red hot. After the box is cool the articles will be covered with a black glossy coat, formed by the tarry constituents of the coal. By this method the tar penetrates into the pores of the metal, and will endure as a protective coating for six months.

The coinage executed at the several mints of the United States during the month of April consisted of 7,533,835 American pieces, having a value of $28,230,682. The coinage of American pieces included 1,365,378 double-eagles, 1,096,000 half-dollars, 160,000 quarter-dollars, 1,790,000 dimes, and 3,122,457 five-cent pieces.

MEXICAN NOTES.—II.

Written for the MINING AND SCIENTIFIC PRESS
By MARK R. LAMB.

The *hacienda* Loreto is shown in Fig. 6 and 12 as it appeared during its transformation from the patio to the cyanide process. The ore-bins are of cut stone, and are more than a century old. They receive the ores from the numerous mines controlled by the company. The immense size of these bins may be judged by comparing dimensions with the 40-stamp mill shown under construction in front of two of them at the extreme right of Fig. 3. Massive masonry vats to contain water are shown in this photograph. In Mexico, roofs such as are seen in the foreground of Fig. 3 are usually made without nails. Rafters and joists are tied together with thongs and the shakes are similarly secured. The extensive roofs over the large cumbersome *malacates* or whim-hoists are so built, and seem to be as strong as ever. In these pictures the amalgamation patio is being covered with slime agitation-vats, which are shown

Fig. 7. Slime Plant Under Construction.

completed in Fig. 7. Note the apparent size of the road roller to the right of the picture, and also the height of the edge of the exeavation from which the picture is taken, showing the labor required to prepare the patio. It should not be forgotten that this work was done without the aid of modern explosives.

The picture (Fig. 8) of the supported double pipe-line shows two methods of ore transportation. The pipe-line transports pulp over a mile from the mill to the leaching-plant, while the burro, the best of the native laborers, is taking ore to the mill. These transportation lines are not competing; in fact, since the railroad merger, there are practically no competing lines in Mexico. The view of the San Matias mill (Fig. 2) shows the old works in the foreground with typical lookout towers and rifle-slots. All the old mines are equipped

Fig. 9. A Copper Furnace.

with ample house-room. Cleaning and furnishing fits them for better and more comfortable homes than are the wooden structures usually found around mines. At this point it may be well to advise the young miner or metallurgist to choose his employers from among French or English companies if he desires to live comfortably. With a few notable and saving exceptions, the American companies expect their employees, from superintendent down, whether married or single, to live in a shack, and to furnish it.* They rarely sign a contract for a term of years with an employee, and the

Fig. 8. Pulp Pipe-Line.

*[Our own experience would lead us to believe that Mr. Lamb was unduly accentuating some special cases of neglect. The American companies do not encourage extravagance, but provide well for those having charge of their operations, so far as we have seen.—Editor.]

average mill man moves about twice a year. On the other hand, the English company usually investigates the man before employing him, and then knows what to expect. They do not ask for perfection, neither do they so often get stuck with rankly incompetent or intemperate men. A man in a foreign country with a contract feels more contented and willing to give his best efforts than when he is not sure what may happen from one day to the next. If the companies but realized it, this feeling is a greater incentive than double wages. This diatribe may not be in place here, but it touches a subject of much greater importance than the efficiency of

Fig. 10. An Adobe Smelter.

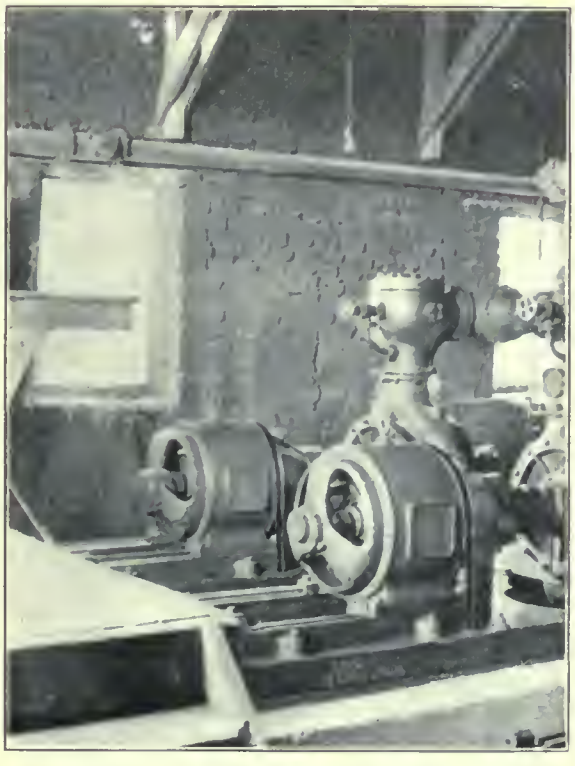


Fig. 11. Direct-Connected Centrifugal Pumps.

Fig. 12. Cyanide Plant in a Patio.

pumps or the best ore-mixture for pyritic smelting.

A two-stack copper smelter, built to smelt Cananea ores, is shown in Fig. 9. It was a commercial success, producing metallic copper directly from ore. The copper was worked into utensils and sold on the ground to consumers, thus combining under one control, mining, smelting, converting, manufacturing, and wholesale and retail selling, which is more than the present Cananea company is doing. The hat of the blowing engine for these two stacks is just visible between them. Fig. 10 depicts the ruins of a more pretentious reverberatory and roaster of adobe construction throughout. The two single-stone rollers of a Chilean mill are visible on the left. Near this is a smelter that was built for copper-matting silver ores. The fact that the ore contained no copper did not deter, as scrap copper was shipped in from the States to the nearest railway station, whence coke and copper-scrap were hauled 40 miles in two-wheeled carts. It is hardly necessary to say that the plant is not now in operation, though an approaching railway may induce the resumption of operations.

The manner of bringing water to the old plant in times past is shown in Fig. 5. Note the protection from destructively inclined persons afforded by the rifle-towers. The *noria alta* (high water-wheel) is built on a bank of the river and reaches from water-level to a point high enough to convey the water by gravity to the treatment plant. Horses traveling in a circle on the top of the well and hitched to a wooden-pin gear, operated a unique bucket-elevator which raised the water. From the top of the well it flowed along the arched aqueduct to the patio. In contrast to this is Fig. 11, showing a direct-connected high-duty centrifugal pump. This type of pump has been thoroughly tested in Mexico, and I have yet to hear anyone express preference for the mover plungers. Fifty per cent seems to be the maximum efficiency under the best conditions to be obtained in common practice. The best Swiss pumps have been replaced by triplex and quintuplex geared and belted plungers, even when the lift is not excessive.

GOLDFIELD, NEVADA.—III.

Geological Notes.

Written for the MINING AND SCIENTIFIC PRESS
By T. A. RICKARD.

Owing to the limited extent of the underground workings and the comparative newness of the mines, the geology of Goldfield is difficult to decipher. One of the first published accounts of Goldfield appears in Bulletin No. 260 of the U. S. Geological Survey, in the form of a short report by J. E. Spurr, who visited the district in November, 1904. This was long before the big discoveries. I presume that Mr. Spurr would like to see this early document destroyed, for it was written before the necessary facts were available. He emphasized the lack of persistence and want of definition exhibited by the veins of the district, and concluded that "these irregular reefs represent the horizontal sections of columns of rocks traversed by rising columns of hot waters. . . . It follows that the quartz bodies will probably, as a rule, extend deeper vertically than horizontally, and so have roughly the nature of columns or pipes." No one would recognize in these generalizations any description of the ore deposits as exposed today. Mr. Spurr has done such splendid work at Tonopah and Silver Peak, that it is surprising he should have so ill interpreted Goldfield. Undoubtedly he was the victim of that haste of publication to which the Survey is occasionally committed in the desire to please the politicians and other local powers that clamor for geological reports even before the necessary evidence is contributed by actual mining.

The next scientific investigation was made about a year later, by F. L. Ransome, who was at Goldfield at the end of 1905 and the beginning of 1906. His report appears in Bulletin No. 303 of the Survey. This work was less sketchy, although preliminary. Enough evidence was collected to warrant the comprehensive and illuminating statement that the district covers a domical uplift of Tertiary eruptives resting upon highly altered sedimentary rocks of probably Paleozoic age. This appears to be the key to the correct understanding of the local geology. In February, 1906, John B. Hastings and Charles P. Berkey contributed a valuable paper on the geology and petrography of Goldfield to the Transactions of the American Institute of Mining Engineers. This paper is often quoted by the local mine managers and it contains much useful information. The identification of the chief rock-types shows results varying slightly from those of Mr. Ransome and bearing a closer resemblance to the rocks of Tonopah. Hastings emphasizes the extreme silicification of the eruptives along systems of fracture and the evidence of wide-spread solfataric action.

The most recent description of Goldfield geology will be found in an excellent article on the Combination mine, written by Edgar A. Collins, and published in the MINING AND SCIENTIFIC PRESS of September 28 and October 5, 1907. This gives a detailed account of underground exploration by the manager of the mine that first made Goldfield famous.

When F. L. Ransome made his preliminary investigations more than two years ago, the great bonanzas had not been discovered and Goldfield gave no signs of its recent prominence as a mining district. Since then, I am informed, there has been a disposition to discourage further scientific examination by the Government geologists because of litigation as to mineral rights between different mining companies. The completion of the big merger of many of the principal mines has removed several likely points of dispute, but even now two or three important suits are pending, involving questions of extra-lateral right, and while I was at Goldfield I found Horace V. Winchell, W. H. Wiley, Charles J. Moore, and other mining geologists engaged in collecting evidence to serve as ammunition in the courts. The law is not always synonymous with justice, nor is

Glory Hole of the Combination Mine.

mining litigation necessarily a stimulant to the ascertainment of scientific facts. Too often these quarrels over mining territory breed a bastard sort of theory and in any event the effect of them is to silence the men best able to contribute to our knowledge of local geology. So, for the present, there is not much more to be said than that the prevailing rocks are Tertiary eruptives forming a low dome over a core of much older metamorphic sediments.

As is usual in ground that has undergone intense mineralization, the structure of the orebodies is indefinite. Obvious boundaries and simple definition are more likely characteristics of poor lodes than of rich ones. Diffuse impregnation with ore tends to obscure the relation between the vein and the rock it traverses. The prevailing rock is dacite, which has a porphyritic habit by reason of phenocrysts of feldspar. This feldspar is labradorite; in fresh dacite it

is white to pale green; by alteration to alunite it becomes pink. The dacite is essentially a quartz-andesite. This is the rock in which most of the rich ore is being found. It is covered by patches of 'wash,' or débris, so that the surface exposure is incomplete, but enough evidence is available to indicate that it extends over the principal portion of the rolling plain occupied by Goldfield. Several knobs, such as Columbia and Vindicator mountains, appear to thrust themselves through the dacite, but they are really older masses that have survived erosion. They represent cores of hard calcareous shale (of Cambrian age) flanked by alaskite and rhyolite. The dacite is broken by several faults, the most important being to the west of the bonanza ground

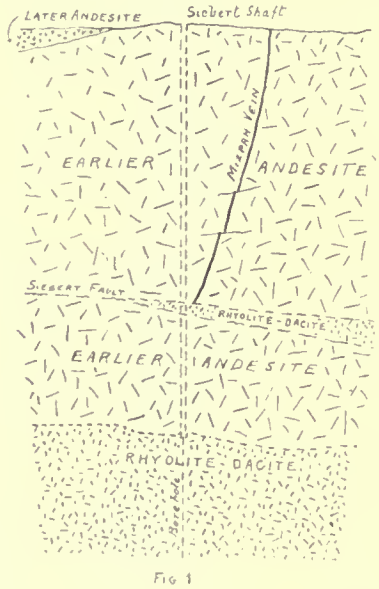


FIG 1

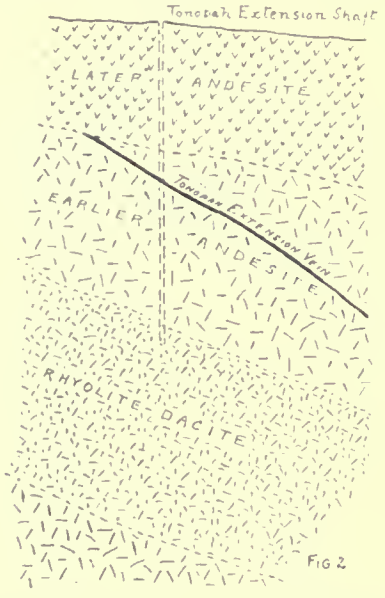


FIG 2

and apparently limiting it in that direction. West of the fault the rock is an earlier andesite. The thickness of the dacite is not known; the deepest workings, at 600 ft. in the Mohawk, are still in this formation. On the bottom level of the Combination (380 ft.) some andesite appears under the dacite, the andesite dipping about 34° northeast. The relation between the two formations is a matter of importance, for if ascertained it would answer the question whether the dacite is an intrusion or a thick layer. At Tonopah the petrography proved the key to the mining geology in an unexpected way, as the accompanying sketches[1] illustrate. Fig. 1 shows the Mizpah vein traversing an earlier andesite and cut off by an intrusion of later rhyolite-dacite; while Fig. 2 shows the Tonopah Extension vein, which does not penetrate the later andesite and fails to reach the present surface. By reference to Fig. 1, it is seen that the Mizpah vein just missed being covered by the later andesite (shown to the extreme left of the section) and so yielded an outcrop the richness of which led to the development of the Tonopah district. It is evident that the veins were formed during a period intervening between the extrusion of the two andesites. It is likely that the deposition of ore was a sequel to the thermal activity that followed the extrusion of the older andesite.

At Goldfield the ore was found at the surface as an enriched portion of one or two ridges of quartzose rock. These ridges were combs formed by the silicification of the dacite along lines of fracture. In the rich area the chief lines of fracture run nearly north and south, and they are marked at intervals by

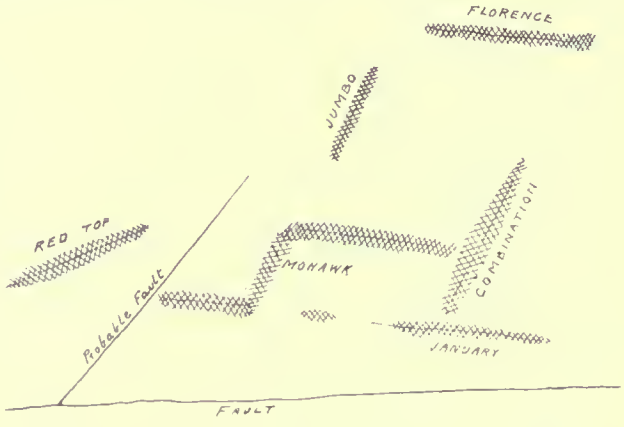


Fig. 3. Sketch Showing Relative Position of Orebodies.

these outcrops or 'blow-outs' of silicious rock. Most of them are poor, if not barren, and it was only on the Combination, January, and Jumbo that the early prospectors were able to find pay-ore. Most of the orebodies were discovered by haphazard sinking of shafts and cross-cutting into these same masses of silicified dacite at a lower level. For instance, Hayes and Monette, in their famous lease on the Mohawk, struck the first ore by cross-cutting at 150 ft. They cut it at 25 ft. from their shaft. The finest showing was just below the 150-ft. level, where they had two feet of ore assaying $15,000 per ton. This was a black heavy sulphide streak, from one inch to two feet wide; it persisted with regularity for 130 ft. on the dip. The lessees extracted a lot of 49 tons that assayed $6.50 per pound. The bottom of the zone of oxidation was between 105 and 115 ft. below the surface. In the Mohawk ground the pay-ore usually did not extend into the oxidized zone, but in the Sheets Ish and the Combination it reached to the surface.

The accompanying sketch shows the distribution of the principal orebodies as known today. It suggests that there is a system of co-ordinate fractures, which are not exactly at right angles. The north-

[1] 'Geology of the Tonopah Mining District,' J. E. Spurr, U. S. G. S.

south members dip east from 34 to 50°; along them are found the Red Top, Mohawk, Florence, and part of the January lodes. The east-west (or more accurately, west of north) members are nearly vertical, for example, the Combination and the Jumbo. At the intersections of these lines of fracture there has been intensified mineralization, which has been supplemented by faulting, followed in turn by another period of ore deposition, leading to further enrichment. By faulting, the co-ordinated fissures have been shifted so as to accentuate the multiplicity of fracturing and assist mineralization. The lode-channel thus formed has been dislocated in many places by cross-faults but the rich streaks within the lode-channel appear only to have been diverted, that is, the later enrichment following the fault-lines. In the hard silicious mass of the lode-channel the faulting is easy to follow but in the soft outer country it is difficult to trace. Minor movements complicate the structure, especially within the larger orebodies. It is dangerous to label the individual veins and to try to trace them for any distance; they lose their identity and become part of a larger linked system. Bulges and violent changes of strike in the veins and in the main hanging wall of the lode-channel suggest an end-thrust, causing a buckling of the dacite. The best ore is found in the bulges, reaching in places from hanging to foot-wall for the full width of the lode-channel, that is, 500 to 300 ft. Thus splendid orebodies have been found. In the Mohawk the rich ore is continuous for 800 ft., and in the Combination for 500 ft., reaching out to 1000 ft. The deepest working is the winze below the 450-ft. level in the Mohawk; this is down 160 ft. on the dip, or within 50 ft. of the 600-ft. level. This winze, 8 ft. wide by 12 ft. long, has already yielded $75,000 worth of ore, and as much more is in the bins. The average has been $135 for a minimum of 6 ft. and a maximum not yet ascertained, as it exceeds the width of the winze. This is an encouraging fact, and while deeper development may at any moment break into the older andesite supposed to exist under the dacite, it is apparent that the depth already proved leaves ample room for the existence and exploitation of extensive orebodies.

The lode-channel has become, by silicification, harder than the surrounding country. If you walk into a cross-cut and see ahead some white rock fallen from the roof, you know that at that point the cross-cut has passed into the outer dacite. But while the lode-channel as a whole is hardened by silicification, the best ore is along lines softened by intense chemical action, resulting among other effects in the formation of seams and patches of the white substance called 'tale' by the miners. It is mainly alunite, a hydrous sulphate of aluminum and potassium.[2] Hugh Trenholm, superintendent of the Red Top, told me that this 'tale' is a good sign, especially when gritty. The rich ore is usually a seam of dark chalcedonic quartz, carrying needle-shaped crystals of bismuthinite (bismuth sulphide), together with gray copper, pyrite, and occasionally tellurides, such as calaverite.[3] This rich stuff is commonly flanked by mineralized and silicified rock rich enough to be classed as ore. The gold itself is not easy to see, even in the richest ore, until the specimen is wetted; then it is seen in dull yellow bands formed by minute particles of gold arranged along lines of crustification. The gold is like paint, if you please, but unlike that of Kalgoorlie, which was soft, as metal newly precipitated from solution, and required to be scratched to be detected. The burnishing developed the yellow-red glint of the noble metal. At Goldfield the gold is fine, but crystalline, and therefore quite different from the 'mustard gold' of Kalgoorlie. It appears to have been deposited with the chalcedonic quartz, which it ribbons. The gold is sufficiently free to permit of the use of the pan in ascertaining what is rich ore. Mr. Collins states that it was impossible "to tell pay-ore from worthless vein-stuff by its appearance," but panning served as a trustworthy guide. Visible gold was most abundant in the Mohawk ore after a depth of 300 ft. below the zone of oxidation had been attained, that is, over 400 ft. altogether below the surface. Some handsome specimens of free gold were extracted in the winze, at 50 to 70 ft. below the 450-ft. level, and these were identical with specimens broken in the Florence mine. The Florence is a smaller, better defined vein than the Mohawk, and I expect to see the latter become smaller and more clean-cut in depth when once below the horizon of maximum enrichment, just beneath the zone of oxidation. In the Florence a 3-ft. stope suffices; the ore thus broken in the Little Florence lease has averaged $200 to $250 per ton, down to 400 ft., where the orebody pitches into adjacent ground. It is said that 5200 tons have been shipped from this lease for a gross yield of $1,250,000. The rich streak is usually only a few inches wide; the vein is well-defined and reminded me of some I had examined in Boulder county, Colorado.[4] The Florence orebodies are not long, say 75 ft., and in some cases isolated masses of rich ore have been found in the foot-wall country, at the intersection of fractures. One of them, at the 400-ft. level, was 12 to 15 ft. diam., 70 ft. high, and roughly egg-shaped.

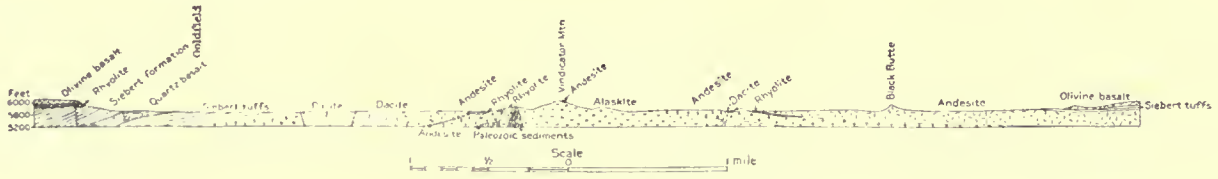
The mine managers speak of a hanging and a foot-wall, meaning thereby the eastern and the western limit of their exploration, for in the Red Top, I saw good stopes on a vein beyond what was once called the hanging, and a rich vein (several feet wide) beyond what was formerly regarded as the foot-wall. These 'walls' are marked by a selvage of clay, they are lines of faulting and lose themselves in other slips and gouge-seams. The most persistent of the eastern 'walls' in the Mohawk is called the hanging; it rolls both in strike and dip, so as to form large bulges, as if the lode-channel had been crumpled by pressure from the north and south. Rich ore is found within these bulges and across them, as well as along the principal 'walls'.

Every observant visitor to a new and very rich mining district wonders whether the orebodies will

[2] 'The Association of Alunite with Gold in the Goldfield District, Nevada,' by F. L. Ransome. *Economic Geology*, Vol. II, No. 7.

[3] Telluride minerals are rarely visible. In two analyses of a concentrate obtained from a mill-test on Mohawk and Combination ore, the following results were obtained: The first analysis gave 0.25% Te and Se, with 41.5% S; the other gave 0.27 Te% and Se, with 42.69% S. The concentration was in the ratio of 39 to 1, and about two-thirds of the sulphur went into the concentrate.

[4] 'The Veins of Boulder and Kalgoorlie.' By T. A. Rickard. Trans. A. I. M. E., Vol. XXXIII, p. 567.



Geologic section across the Goldfield district on line *A-B*

Olivine basalt. (Flows and small intrusions.) | Rhyolite. (Later flows.) | Siebert tuffs (Lake beds including thin flows of rhyolite.) | Quartz basalt. (Flows interstratified in Siebert tuffs.) | Volcanic breccia. (Roughly bedded local deposit.) | Quartz latite. (Flows with some rhyolite.) | Dacite. (Intrusive masses.) | Andesite. (Later flows and intrusions.) | Rhyolite. (Earlier flow with intrusive masses and tuffs.) | Andesite. (Earlier flows.) | Alaskite. (Intrusive in Paleozoic sediments.) | Paleozoic sediments.

PRELIMINARY GEOLOGIC MAP OF THE GOLDFIELD DISTRICT.

United States Geological Survey. F. L. Ransome, Geologist.

persist. Facts are wanting wherewith to base any conclusion as regards the future of Goldfield. In the big mine—the Mohawk—there is a length of 600 ft. of ore proved on the 350-ft. level; at 450 ft. there is 300 ft. of ore known to exist, but there is promise of 500 ft. of stoping ground on the main orebody. Below the 450-ft. there is only the winze, which has been sunk 160 ft., in the heart of the orebody and with the most encouraging results, as already stated. Owing to the dip, each 100 ft. of vertical depth gives 140 ft. on the lode. A body of ore 500 ft. long, 140 ft. high, and 12 ft. wide, represents 64,000 tons, and this at $50 per ton, means over three million dollars. But the estimation of ore reserves at Goldfield is a tricky problem. It is always difficult where ore is rich and variable within wide limits. A careful man will be more willing to assert his ability to maintain a certain production for a minimum period than to commit himself to a statement of ultimate profit.

Since my visit to the Mohawk, the lode has been cut on the 600-ft. level in a cross-cut at a distance of 380 ft. east of the main shaft. Measured at right angles to the dip, the ore is slightly over 20 ft. wide, and the average of 51 sectional samples is $51.50 per ton. There is a central core of 8 ft. of stuff that averages $75, with a gradation in value toward each wall. The cross-cut is being continued eastward and is going through lode-matter assaying from $1 to $4 per ton. When the dacite of the hanging wall is reached, a drift will be started each way on the ore. Another favorable development is the finding of ore on the 380-ft. level of the Combination, where four feet of $35 to $40 stuff has been exposed, with no foot-wall as yet in sight. It is a pleasure to chronicle these happenings, as well as a promising discovery on the Laguna ground. No mining engineer of any experience can go through the workings of the Consolidated group of mines without being impressed by the large amount of rich ore, the unsystematic way in which it was worked by the former lessees, the difficulty of estimating the ore reserves, the possibilities of further discovery, and the evidence of widespread enrichment. But as surely as you do not know how much ore there is in a mine, so surely you are likely not to know how little there may be, and no thoughtful man can fail to regret the huge capitalization of the Goldfield Consolidated Mines Co., with its nominal capital of $50,000,000, its issued stock of $35,351,710, and its present market valuation of $21,000,000. Geological possibilities are not liquid assets.

A topographic map of the Controller Bay region, Alaska, issued by the U. S. Geological Survey, is ready for distribution. The map covers an area of 430 square miles, lying 1250 miles northwest of Seattle and 400 miles northwest of Sitka, and includes the entire area of the Bering River coalfield and the Katalla oilfield. Katalla, the most important town in the area mapped, will be the tide-water terminal of two railroads now under construction. The map will be sent to any address for 35c. on application to the Director of the Survey, Washington, D. C.

The Prospector.

Owing to the large number of specimens forwarded to this department, it has been found necessary in future to make a charge of 25 cents to subscribers for each determination, and $3 to non-subscribers.

From D. H. P., Hamilton, Nevada, a glassy volcanic ash, showing plainly lines of stratification and cross-bedding.

Received from R. S., Kellogg, Idaho, a disintegrated granite re-cemented without much transportation of constituents; an arkose.

From R. D., San Francisco: The specimen of coarser grain is a much weathered phase of an argillaceous sandstone; the finer grained specimen, a schistose phase of a sandy shale.

From F. G. C., Lordsburg, N. M.: 1, iron pyrite; 2, a specimen too small to determine whether vein matter or a metamorphic rock composed of quartz, chlorite, serpentine, and calcite in veins and as an interstitial filling, all impregnated by pyrite; 3, an impure quartzite veined by calcite; 4, granite, possibly gneiss, impregnated by pyrite.

From J. P. C., Cuprite, Nevada: 1, drusy aggregate of calcite crystals in vein in impure limestone; 2, shale; 3, shale, with flakes of muscovite; 4, quartzite veined with calcite; 5, quartzite; 6, quartzite seamed by veins of hematite; 7, fine-grained sandstone with calcite-limonite cement; 8, sandstone with calcite-limonite cement showing scales of specular hematite; 9, medium-grained sandstone with lime-iron cement; 10, argillaceous limestone with nodules of iron carbonate; 11, sandy shale with veins of siderite; 12, quartzite, or possibly vein quartz (small specimen; 13, rhyolite; 14, druses of quartz and calcite crystals coated with hematite, in quartz, limonite rock.

From B. DeL. Gold Mines Co., DeLamar, Nevada: all specimens highly decomposed by weather, and consequently difficult to classify precisely: 1, fragmental acid volcanic tinted pink by hematite, a rhyolite tuff, or possibly a dacite tuff; 2, rhyolite tuff; 3, pyritized acid volcanic, probably from rhyolite tuff; 4, rhyolite; 5, rhyolite tuff, extremely weathered; 6, fine-grained kaolin limonite aggregate with a little quartz, structure indeterminate, derived from rhyolite or andesite; 7, coarse rhyolite tuff; 8, acid tuff, some quartz; 9, rhyolite; 10, rhyolite tuff, reddened by hematite; 11, quartzose rhyolite tuff; 12, a tuff weathered to an extreme degree, traversed by veins of chalcedony and manganese oxide; 13, acid volcanic made very porous by leaching, leaving pore-walls coated with oxides of iron, with pyrite and manganese oxide in small quantity.

The largest gold production ever credited to California was $81,294,700, in the year 1852. The lowest production since 1850 was in 1889, when it was $11,212,913. For the past 12 years it has ranged between $12,000,000 and $17,000,000.

COPPER DEPOSITS IN THE WESTERN FOOTHILLS OF THE SIERRA NEVADA.

Written for the MINING AND SCIENTIFIC PRESS
By WILLIAM FORSTNER.

These deposits have been the subject lately of three articles; one by Herbert Lang in *The Engineering and Mining Journal* of November, 1907, and two by John A. Reid, in *Economic Geology*, Vol. II, No. 4, and in the MINING AND SCIENTIFIC PRESS, March 21, 1908. As I had occasion, a couple of years ago, to examine a number of deposits of copper in this region, I venture to present a general description of the belt, with such a short description of some of the deposits as will emphasize the geological conditions.

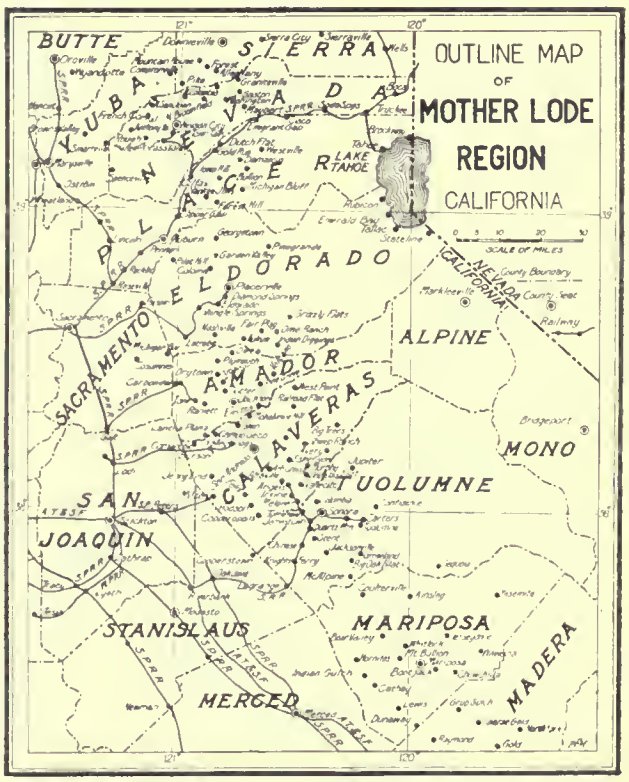
Description of Rock Formations.

Granodiorite is a term applied by the U. S. Geological Survey for the intermediate rocks between granites and quartz-diorites. The rock is distinctive and cannot easily be mistaken. The feldspars are generally white, the quartz is not conspicuous and does not occur in large grains; the hornblende is dark green, often in long rough prisms; the biotite has the usual dark color. The general effect is a light-gray color.[1] Where the granodiorite has been rendered schistose, it is converted into a grayish-green rock, breaking into flat irregular fragments, bounded by smooth greenish faces, with greasy feel.[2] It weathers with rounded outcrops (Smartsville folio, U.S.G.S.).

Gabbro-diorite comprises several species of rocks: normal gabbro, norite, hornblende-gabbro, olivine-gabbro, all frequently altered into uralite-gabbro; and also dark basic diorite. They are generally coarse-grained rocks of dark color. These rocks generally occur near the contacts of the large granodiorite areas, and are separated from the latter, sometimes by sharp contact, sometimes by gradual transition.

These granodiorite and gabbro-diorite areas represent geologic units intruded and consolidated within a relatively short time interval (Smartsville folio).

The term 'porphyrite' has been applied to pre-Tertiary andesites, and as such is applicable to these rocks, which are of pre-Cretaceous age. In the older folios of the Survey this term was used throughout for a complex of rocks occurring along the western foothills of the Sierra Nevada in long belts, generally parallel with the belts of sedimentary rocks between which they lie. They are poor in silica, rich in iron and magnesia. This series includes several species of rocks so intimately connected by transitions that it is not as a rule possible to subdivide them in the field. It comprises medium-grained diabases, augite-porphyrites, hornblende-porphyrites, and breccia and coarse and fine tuffs of the same rocks. These rocks are frequently altered into uralite-diabase and uralite-porphyrites. They are often designated under the collective term of the 'greenstone' series. The relations of this series to the sedimentary series are not established beyond doubt. Probably these rocks should be regarded as intrusive, and not as interbedded masses. As to their age, it is probable that these rocks were erupted both in the Carboniferous and in the Jurassic period; they are intruded into the Carboniferous formation and may represent surface flows contemporaneous with the Jura-Trias slates, and intrusive dikes into them, as both forms of eruption are known in connection with the Mariposa formation. The relation of the diabase, porphyrite, and amphibolite with the granodiorite is not quite clear. In the Sacramento and Sonora folios, the granodiorite is stated to be intrusive and of later age than the inclosing amphibolite and augite-porphyrite; in the Colfax folio, although relating to a region not included in this paper, it is stated: "The general rule holds good that the main granitic area is more recent than the greenstones . . ." In the Smartsville folio, however, it is said: "The contacts



of the diabase-porphyrites with the granodiorite and gabbro-diorite are sometimes exceedingly sharp, . . . sometimes ill defined . . . In many cases it is difficult to avoid the conclusion that a gradual transition exists between the granodiorite and the diabase." And further: "In the mixed granodiorite and gabbro-diorite areas of the central part the evidence along the contacts is that both rocks are cut by an abundance of diabase and porphyritic dikes usually uralitized, and which appear identical with the porphyrite and the diabase of the main area. Thus at least part of these are later than the gabbro and granodiorite." And again: "The general sequence of the Mesozoic eruptions would thus seem to have begun by the intrusion of gabbro-diorite and granodiorite, followed by extrusion of great quantities of diabase and porphyrites; and larger intrusions of granodiorite ended the eruptive activity."

The altered igneous rocks are generally derived from augite-porphyrites and similar rocks, although occasionally from diorites and gabbros, under the

[1] W. Lindgren. *Am. Journ. of Science*, Vol. 46, 3rd series.
[2] W. Lindgren. 17th *Annual Report*, U. S. G. S., Pt. II, p. 145.

influence of pressure and chemical action, which cause the augites to alter into amphiboles (in part uralite), and the whole rock to be filled by minute needles of that mineral. This green amphibole is a characteristic mineral of these rocks: quartz, plagioclase, feldspar, chlorite, epidote, biotite, white mica, and calcite, in varying quantities are also present. The derivation of these rocks from rocks of diverse chemical composition and texture is clearly shown by actual transitions in the field. Their color is dark green; usually fine-grained with plentiful small amphibole needles. They are often sheared amphibolite schists, locally known as 'greenstone-schists,' or 'gray slates.' In places the schists become chloritic and are sometimes difficult to distinguish from clay-slates. As to the age of these altered igneous rocks, see under porphyrite.

In the Smartsville folio the serpentine is stated to be an alteration of some of the most basic rocks of the gabbro-diorite complex. In the other folios it is marked as intrusive in the porphyrite and as possibly an alteration product of the diabase, porphyrite, and amphibolite. All these statements tend to the conclusion that it is of later age than the diabase-porphyrite.

The Calaveras formation is a complex of Paleozoic rocks with so little connection with the copper deposits that it needs no further discussion. The Mariposa slates are black, very fissile, clay-slates, interstratified with fine and coarse tuffs, dark gray sandstones, and conglomerates; their age is late Jurassic.

General Geology.

In the region here under consideration, there is a wide belt of diabase, porphyrite, and amphibolite skirting the eastern rim of the Great Valley, and intersected by large masses of granodiorites, running from the Yuba river in a southeasterly direction, and abutting to the east against the Calaveras formation. From the American river near Folsom, southward, the granodiorite exposures become much less prominent. A little south of Folsom is the northern extremity of the western belt of Mariposa slates, which continues, enclosed in the 'greenstone' belt, in a southeasterly direction to the southeastern part of Mariposa county, running conformably to the general structure of the entire region. In El Dorado county, as far as I know, the copper deposits are confined to that portion of the greenstone belt lying east of the western belt of Mariposa slates, while in the counties south of El Dorado they are found on both sides of this belt.

In Madera and Mariposa counties, the Mariposa slates show the effects of contact metamorphism, and are to a large extent altered into mica-schist and andalusite-schist. The granitic rocks become again a predominant feature and increase in importance southward. The derivation of the mica-schist in Fresno county is, as far as I know, an open question.

The western belt of the Calaveras formation, which is quite massive south of the north fork of the American river, does not show so prominently farther northward; one narrow tongue runs north, continuous to about a mile south of the south fork of the Yuba river, northwest of Nevada City. To the west, however, especially on both sides of Bear river, small exposures of the Calaveras are found in the diabase-porphyrite, almost to the Pleistocene gravels of the valley. The most rational conclusion to be drawn is that the diabase, porphyrite, and amphibolite represent effusives which were extruded through the Calaveras, and covered the latter formation.

In Nevada and Placer counties, the foothills consist nearly exclusively of the diabase-porphyrite, amphibolite, and the granodiorite-gabbro-diorite.

In Nevada county, a number of copper deposits are found near the contact of the diabase-porphyrite and the extensive granodiorite and gabbro-diorite area, running from Iron mountain north to Challenge in Yuba county. Most probably the copper deposits near French Corral are on the same contact. The relation between the diabase-porphyrite and the granodiorite and gabbro-diorite has been discussed above. Assuming that in this locality the porphyrite is the youngest rock, there is no doubt that it was much fractured near the contact-zone, and as all the deposits of copper ore are found in the porphyrite, and none in the granodiorite, or in the basic dikes intruded therein, the conclusion is inevitable that the source of the copper-bearing solutions must be sought in the magma of the diabase-porphyrite effusions.

South of Bear river, the ore deposits are found in the diabase, porphyrite, and amphibolite, but apparently have no genetic relation with the granodiorite intrusions; in this statement must be included the deposits at the Nickerson ranch, Nevada county. These deposits are possibly related to intrusions of dikes of various chemical composition, with only small surface exposures; and for the more eastern deposits, Oest ranch and Nickerson ranch, to the intrusions of peridotite and pyroxenite, partially altered to serpentine, running from Auburn to Grass Valley in intermittent exposures and closely related to the western band of the Calaveras formation.

In Mariposa and Madera counties, the copper deposits are found in mica-schist and andalusite-schist, which may be alteration facies of the Mariposa slates. The Pool mine in Calaveras county is also in the Mariposa slates.

Nevada County.

The Mineral Hill district is situated on Dry creek, between Smartsville and Spenceville. A number of prospects are located in this district in close vicinity to each other. The country rock is diabase-porphyrite, altered to a variable extent, partially serpentinized, and in places rendered schistose. All the rocks carry disseminated pyrite; the portions, sufficiently mineralized to form ore, are apparently zones of fracturing of the rock, in which are often found segregations of quartz. There are several more or less parallel zones of fracturing, having a northwest strike and northeast dip, accompanied by occasional faulting. In and near these fracture-zones the rock has a schistose structure, the planes of schistosity parallel to the direction of the fracture-zones; in the intervening areas the rock is more massive, with a blocky structure. As a general rule the schistose

rock contains much more disseminated pyrite than the massive portion.

The mineralization has taken place through replacement of the silicates of the porphyrite by pyrite, often in the form of marcasite, bornite, chalcocite, and covellite; the last three being found in the zone of secondary enrichment. In one mine, the Arkansas Traveler, vugs with incrustations of quartz and pyrite were observed. Occasionally quartz deposition without accompanying pyrite deposition is found. A number of outcrops exist, in most cases not continuous far, although this cannot be ascertained as the hillsides are covered with débris. Where developed underground these outcrops have been proved to be underlaid by sulphides. In former years only the rich ore could be mined; it was confined to the zone of secondary enrichment. From what is disclosed in the accessible workings I conclude that the orebodies are not continuous, but have formed in such portions of the zones of fracturing, determined by the talcose planes resulting from movement.

The Pine Hill mine is in the diabase-porphyrite to the south of the granodiorite-gabbro-diorite area. In this property the underground works show a great amount of clay, which would suggest the presence of some highly feldspathic rock, although the vein-filling is apparently a more basic rock. There is a possibility that the ore is formed in the diabase-porphyrite, between two quartz-porphyry intrusions close to each other. The gossan must have been pretty rich in precious metals, for the mine was in former years extensively worked for gold.

The Indian Springs mine is situated east of the Mineral Hill district. Croppings abound on this property, the country rock carries disseminated pyrite and weathers with purple and ochreous colors, giving it a likeness to limonite, which must be differentiated from the true limonite croppings. The latter form two zones, having a general north and south direction. The surface is decomposed to a depth of 40 ft. into an ochreous clayey material. The ore consists of rather coarse brittle pyrite with some silica. The texture of the ore, which is a replacement product, would indicate that the original rock in which it formed was of a character different from the country rock; this is confirmed by the texture and composition of the filling between the ore, and leads me to the suggestion that more basic dikes have intruded into the country rock and formed zones of circulation for the mineral-bearing solutions, which replaced part of the silicates of these intrusions by sulphides.

The Nickerson ranch is on Wolf creek, near its junction with Bear river. The ore deposits form in diabase-porphyrite, on both sides of a narrow belt of Calaveras formation, which in turn is separarated into two parts by a serpentine intrusion. The matrix of the ore is quartz, heavily charged with pyrite; the ore occurs in elongated lenses. As the serpentine is generally conceded to be later than the porphyrite, it is possible that the ore deposits were due to the fracturing of the porphyrite by the serpentine intrusion.

Placer County.

The Dairy Farm mine is in the northwest part of this county, about one mile south of the McCourtney crossing of the Bear river, on the contact of diabase-porphyrite to the west and amphibolite-schist to the east. The schist is much altered and in the zone of oxidation forms a white clayey material. It differs to a certain extent from the facies of true amphibolite-schist, and may probably be an altered quartz-porphyrite (a more silicious porphyrite, often closely related to the ordinary porphyrite, consisting of porphyritic decomposed feldspar crystals and decomposed augite and hornblende, in a light-gray flinty ground-mass of small feldspar crystals and quartz grains, and containing frequently much epidote).[3] This schist forms the hanging wall, the diabase the foot-wall. In both formations occur small elongated lenses of quartz-porphyry. As to the genetic relation of these quartz-porphyry intrusions to the ore deposition, their intrusion certainly fractured the rocks, and although probably the ore-bearing solutions found their source in the diabase-porphyry magma, as was the case with those in Nevada county, only a few miles to the north, they possibly afforded conditions favorable to ore deposition. The granodiorite, a little over a mile west of the Dairy Farm mine, is intruded into the diabase-porphyrite, and hence younger than the porphyrite, but whether this granodiorite and the quartz-porphyry are younger or older than the ore deposition is an open question.

The orebody in the Dairy Farm mine forms a large lens. The ores are the result of replacement in a zone of fracturing; all through the orebody the planes of fissuring can be seen, roughly parallel to the planes of schistosity of the hanging-wall schist. Plates of unmineralized, or only partly mineralized, schist run through the orebodies. On the contact of the oxidized zone and the sulphide zone the transition occurs suddenly, with scarcely any of the secondary copper sulphides generally found in the upper portions of the sulphide ores.

The Valley View mine is located six miles northeast of Lincoln and about the same distance east of south of the Dairy Farm mine, in the same belt of amphibolite schist as the latter, close to the contact of a large area of granodiorite. Two intrusive dikes can be traced on the surface.

The Oest ranch, about 6½ miles north of Auburn, on the road to Grass Valley, is a copper deposit in typical porphyrite, altered andesite, carrying disseminated pyrite. The fractures of this rock are refilled by quartz containing thin seams of siderite. In the gangue is found some serpentine. The belt of porphyrite in which these deposits lie is about one mile wide, between the Calaveras formation to the west and a boss of granodiorite to the east. The Calaveras forms a narrow band and is accompanied by a belt of pyroxenites, peridotites, and serpentine. These intrusives may have a genetic relation to the ore deposition.

El Dorado County.

The Baker mine is located about 2¾ miles south of Placerville and 1½ miles east of Diamond Springs, in a belt of Mariposa slates, cut by a number of small dike-like intrusions of granodiorite. The fis-

[3] Colfax folio, and *Bulletin* 139, U. S. G. S., page 97.

sures cut the slates at acute angles, both in dip and strike. Probably the vein filling is formed by narrow intrusive dikes of granodiorite, altered to a more or less extent into copper-bearing pyritic ore.

The Lily-Emma mine is situated on Halsey creek, about two miles above the south fork of the American river, and about six miles northeast of Coloma. The country rock contains augite and garnet and secondary chlorite, and might be considered a pyroxenite. A dike of fine-grained peridotite apparently cuts off the mineralization to the south. The ore consists of quartz with calcite and chlorite, and contains patches of pyrite associated with chalcopyrite. It has undoubtedly formed in a fractured zone of the pyroxenite.

The Noonday mine and smaller deposits in its vicinity are 3½ miles east of south of Mud Springs and on the east bank of Square Hollow creek. They are in a belt of the Calaveras formation. In the Noonday the vein is conformable with the dip and strike of the country rock, the ore is highly pyritic, containing little silica. I observed no signs of any intrusions at the surface in close proximity to the mine. In the Madeline, a little more than half a mile to the south of the Noonday, the vein abuts against a basic dike, containing inclusions of pyrite associated with chalcopyrite and traversed by numerous veinlets of quartz, which is occasionally replaced by similar pyrite.

These deposits in El Dorado county are all east of the belt in which the deposits of Nevada and Placer counties are situated. In the southeastern portion of El Dorado county lies a wide belt of amphibolite and diabase-porphyrite, between Mariposa slates to the west and the Calaveras formation to the east, in which numerous exposures of serpentine occur; this belt persists southward into Amador county. Numerous deposits of copper have been found in this belt; none, however, have been developed sufficiently to pass the stage of prospects.

Calaveras County.

The Campo Seco mine is on the south bank of the Mokelumne river, about 4½ miles west of north of Valley Springs, in the amphibolite schist lying west of the main western belt of the Mariposa slates. The orebodies form in two intrusive dikes of quartz-porphyry, running nearly parallel to the planes of schistosity of the schist, and from 125 to 200 ft. wide. These intrusives are highly altered, to a great extent into a very soft, talcose, thinly laminated schistose material, through which runs a belt, about 50 ft. wide, of much harder, quartzose schist, carrying disseminated small crystals of pyrite, with bands from ⅛ to 2 and 3 in. wide of quartz containing pyrite and chalcopyrite. In places, approaching the ore lenses, these seams come close together and form seams from 18 in. to 2 ft. wide. These narrow bands widen abruptly into lenses, which are in dip and in strike, in a general way, conformable with the schistosity of the intrusive. The lenses are much elongated in the direction of their strike, their longest axis is along their dip, and they trend northward along the strike. As far as ascertained there are no parallel belts of quartzose material in the intrusive dikes, and hence no parallel ore-shoots across the dikes.

The ore consists of massive pyrite, with accessory chalcopyrite, sphalerite, gold, and silver. It grades into the enclosing intrusive, and inclusions of the quartz-porphyry are occasionally found in the lenses. There is a marked difference in the character of the mineralization of the two dikes, as to the relative contents of iron, copper, zinc, gold, and silver. In each lens the content of ore is also irregular.

The planes of schistosity in the dikes, the general trend of the dikes, and the planes of schistosity of the enclosing schist are all parallel; evidently all three are the result of the long sustained orogenic pressure which controlled the deformation of all the formations in this region. The position of the ore lenses must have depended upon the physical condition of the dikes, forming in those portions of the quartzose belt that were most favorable to replacement.

As to the genesis of these ores, all indications tend to the suggestion that they are related to the quartz-porphyry intrusions, and are later than the movements causing the schistosity in the latter, which forms the talcose portions that acted as impervious strata and restricted the mineralized solutions to the harder fractured portion.

The Copperopolis mine lies in that portion of the greenstone belt which is east of the western belt of the Mariposa slates. This deposit has been very fully described by John A. Reid, as already mentioned. According to his description, this deposit forms in a chlorite schist facies of the diabase-porphyrite, close to intrusions of serpentine, a very basic igneous rock, classified by Mr. Reid as hornblendite, granodiorite, and gabbro. The ore forms in numerous minute fractures of the chlorite-schist; its grade depends upon the intensity of fracturing of the schist, the veinlets vary from $^1/_{16}$ to 3 and 4 in. wide. The ore is a mixture of pyrite and chalcopyrite, grading in the richer ore to nearly pure chalcopyrite. Mr. Reid suggests that the separation of the copper-iron and iron sulphides is the result of osmotic pressure, and incidentally accounts in the same manner for the occurrence of pure iron pyrite in the wall-rocks of various gold-bearing ore deposits. The part played by osmotic pressure as a factor in ore deposition is as yet a matter of controversy. H. P. Gillette[4] states as his opinion "that when the solutions are filling the crevices and small interstices in the fissures, there is a concentration of the dissolved material along the walls of these crevices and interstices, due to osmosis, this concentration causes precipitation, and again due to osmosis new particles of the dissolved material is brought to these points, resulting in enlargement of deposited crystals." Mr. Gillette bases his reasoning upon the following determination of the term osmosis: "Osmosis is a force which drives a solute through a solution." I doubt if this determination fully covers the case: as W. Nernst says, the osmotic pressure is due to "the tendency of the molecules of the dissolved substance to occupy the greatest possible space." T. K. Rose states: "Os-

[4] *Trans.* A. I. M. E., Vol. XXXIV, page 711.

motic pressure is a measure of the bombardment of molecules of substances trying to diffuse in a solution." I see nothing in osmosis to cause a concentration of the molecules of the dissolved substance "at the extreme confines of the vessel holding the solvents." Adsorption (that is, the phenomenon whereby in contact-surfaces between solids and liquids, the concentration of the dissolved substance is different from, and usually larger than in the rest of the solution) may take place, and osmosis may restore the equilibrium in the solution thus disturbed. As James Park states, "The osmotic pressure will, if precipitation takes place from a homogeneous solution, instantaneously establish a condition of equal concentration throughout the entire mass." It must be further observed that the osmotic pressure is a function of the concentration, and consequently if one of the dissolved substances was deposited, its osmotic pressure would rapidly decrease.

As to the action of chlorite acting as a semi-permeable septum, impermeable to copper and permeable to iron in solution also suggested by Mr. Reid, I have been unable to find any confirmation. W. Lindgren states with regard to this action of the minerals of the rocks: "They are in general shown to be permeable for hydrogen sulphide, sodium sulphide, or arseno-sulphide; on the other hand, they are less permeable for silica and gold, and almost entirely impermeable for the other metallic sulphides." This certainly is in direct contradiction to the suggestion of Mr. Reid in regard to the formation of pyrite barren of gold in the wall rocks of gold veins carrying gold-bearing pyrite. It is, however, possible that Mr. Reid may be in a position to state many facts bearing upon this question which would confirm his hypothesis; and a paper covering the present status of our knowledge on the subject of the influence of osmotic pressure on ore deposition would certainly be highly appreciated by the profession.

The Napoleon mine is west of the west belt of the Mariposa slates. The country rock in close proximity to the mine consists of silicious igneous rocks, meta-rhyolite and meta-trachyte. The character of the ore varies; it is partly rather silicious, partly massive pyrite; it is most probably an irregular replacement of a basic rock, as some serpentine is found in the inclusions of country rock in the ore; occasionally nodules of segregated quartz are found in the massive pyrite.

The Pool mine is about six miles west of Angels, on the road to Milton, on the east slope of Bear mountain. According to the Jackson folio, this mine is in the eastern belt of the Mariposa slates; the country rock is a chlorite schist; a boss of serpentine cuts through one side of the shaft. Probably the ore forms in an altered basic intrusion, which does not show at the surface sufficiently to be marked on the map. The ore forms in the lamination planes of the schist, occasionally in seams several inches wide, so close together as to form orebodies.

Mariposa County.

The Green Mountain mine is in the southwestern corner of Mariposa county, in a belt of mica-schist 600 to 1000 ft. wide, between a mass of granite lying to the east and south, and a silicious eruptive rock, with a glassy groundmass and comparatively few crystals. The orebody is a more or less irregular mass of mineralized schist, the mineralization following roughly the laminations of the schist. It is probable that the eruptive rock may have had some influence on the mineralization of the schist. As the orebodies do not reach the granite contact it may be assumed that the fracturing of the schist, to which the orebodies are due, was caused by intrusions into the schist. In this particular this mine differs from the Pocahontas mine, a few miles to the northwest, where the ore forms on and close to the contact of the schist and the granite.[5] The mineralization of the schist has been accompanied by the formation of a large amount of amphibole. The ore consists of massive pyrrhotite, containing very little silica and some copper, gold, and silver; also of more or less altered schist, carrying disseminated iron and copper pyrite, in fine particles or streaks.

The Lone Tree mine is a mile northwest of the Green mountain. The sulphide orebody is overlaid by talcose schist, an alteration of the mica-schist. The ore is a pyrite with associated chalcopyrite.

Madera County.

In the extreme western portion of this county, close to a large mass of granite which extends from southeast of Daulton northward to the Green Mountain mine in Mariposa county, a number of copper deposits are found. They are in mica-schist, and form a belt that runs apparently parallel, and at a distance of one-half to one mile west of the contact of the schist and the granite. It appears as if in this vicinity the mineralization has spread over a number of parallel fracture-zones, each of rather limited width. The character of the ore differs in the various deposits: At the Ne Plus Ultra mine (two miles south of Daulton) the sulphide ore is principally a pyrrhotite; in the three parallel veins of the Jessie Bell mine, near Daulton, the mineralization has taken place along seams following the planes of schistosity of the schist, the ore is formed by seams of chalcopyrite, or chalcocite and chalcopyrite, resembling the process of mineralization at Copperopolis. Adjoining the Jessie Bell to the north, a vein of quartz, running conformably to the schist, is opened up to some extent; in this quartz are found leaflets of metallic copper and nests of mica and graphite.

Fresno County.

The copper belt continues into Fresno county. Close to the eastern rim of the Great Valley, the Fresno and the Painter mine are situated in this belt. The Fresno mine is about 15 miles east of north from Fresno. The country rock is hornblende-schist. The mine is not far from the contact of the schist and the granite; the schist overlies the granite. The ore is a cupriferous pyrrhotite, with some pyrite, forming a number of elongated lenses. About two miles northwest of the Fresno mine, is the Painter, in massive mica-schist, surrounded by granite. A dike of diorite cuts through the mica-schist, close to the vein,

[5] J. A. Reid, MINING AND SCIENTIFIC PRESS, March 21, 1908, page 392.

in the trend of the laminations of the schist.

About 18 to 25 miles, a little to the north of east from Fresno, is a district containing numerous copper deposits, of which the Copper King mine is the principal. The prominent rock formation is a hornblende-biotite granite, wherein are found lenses or bodies of altered igneous rocks, varying in composition, including extensive bodies of serpentine, which represent either more basic portions of the original rocks or a local serpentinization. Although my geological study of this district was not detailed, my impression is that this schist formation constitutes a belt, having a general northwest direction, inclosed in the granite; it runs, as far as observed by me, from Mill creek, a southern tributary of Kings river, northward across Trimmer springs to near Sentinel on Big Dry creek. All the copper deposits are in the schist, some on the contact with the granite.

The Copper King orebody lies in the schist, adjoining a more or less altered diabase. It forms one much elongated lens, cut off at the southeastern end by a north and south dike, and feathering out at the northwest end. The sulphide ore is a replacement, and the varieties of the ore probably represent varieties in the original rock: some of the ore contains blotches of zinc-blende, closely imitating a porphyritic diorite with feldspar phenocrysts, which is found fresh in the vicinity of the mine. Other specimens show phenocrysts of quartz, which have been replaced pseudomorphically by pyrite.

Conclusions.

The copper deposits in the western foothills of the Sierra Nevada are principally located in the 'greenstone' series, occasionally in the Mariposa slates, and then generally in their metamorphosed facies, and exceptionally in the Calaveras formation. In places they are close to, and sometimes at the contact with, the granodiorite and granite. There is reason to believe that they are genetically related to the late Jurassic or early Cretaceous eruptions. Before we can, however, advance a well conceived hypothesis on this question, a more careful study would have to be made of the copper deposits scattered to the east of the copper belt. It is a mistaken idea that the copper deposits on the western slope of the Sierra Nevada are limited to this belt: scattered copper deposits are found all along this slope, although possibly under existing topographical conditions, commercially useless.

The maximum pressure on the granite masonry of the towers of the Brooklyn bridge is about 400 lb. per sq. in. In the Washington monument, Washington, D. C., the normal pressure on the lower joint of the walls of the shaft is 280 lb. per sq. in., and the maximum pressure brought upon any joint under the action of the wind is 350 lb. per square inch.

Iron consumption in the United States in April was 979,000 tons, as contrasted with 2,093,000 tons in the corresponding month of 1907. The average shrinkage in consumption for the last four months has been 52% as compared with the same period a year ago.

Decisions Relating to Mining.

Specially reported for the MINING AND SCIENTIFIC PRESS.

INJURY TO MINER—BLASTING WITH DYNAMITE.

A miner who was familiar with the ordinary dangers of blasting with dynamite, was not entitled to recover for injuries occasionad by a delayed explosion, where he determined for himself the length of time he should wait, and where he knew there was a possibility that a charge which had not exploded might explode later.

Wilson *v.* Atlantic Crushed Coke Co., (Pa.) 68 Atlant. 671, Jan., '08.

DEATH OF MINER—PROOF OF NEGLIGENCE.

Where a miner was killed while descending a man-way in a mine, the proof was held sufficient to show that the miner was killed by falling rock due to the negligence of the mine owner in failing to properly timber up the way. It was also held that the evidence was sufficient to justify a finding of freedom from contributory negligence.

Hotchkiss Mt. & Reduction Co. *v.* Bruner, (Colo.) 94 Pac. 33, March, '08.

LOCATION OF CLAIM—AMENDMENT OF NOTICE.

A person in possession of a mining claim, who has done the actual physical work required by the statute, where such work exists as evidence of the possession, and where there are no intervening rights, such person may amend his location, and thereby perfect his entry; and his right cannot then be defeated by one who had made no peaceful entry and possession of the land, and who had done no work thereon.

Ware *v.* White, (Ark.) 108 Southwest. 831, Jan., '08.

LOCATION OF MINING CLAIMS—MARKINGS.

The mere disconnected markings of a mining claim, unaccompanied by work, and without actual possession, are held insufficient to constitute a location.

Ware *v.* White, (Ark.) 108 Southwest. 831, Jan., '08.

MINING PARTNERSHIP.

By an agreement between the owner of a mine and another person, the latter was to furnish the necessary labor in operating the mine, and each was to receive one-half the profits, to be divided after they had reached a certain amount, and the latter person was then to receive a half interest in the mine; or such person was entitled to purchase a half interest of the mine at any time for a certain sum. Such second person then entered into an agreement with other persons by which they contributed various amounts to work the mine, and for the purpose of securing the option, and such second person agreed to convey to those so contributing, of the interest he was to receive, amounts in proportion to their contribution. In a controversy among such persons, it was held that the agreement created the relation of partners as between such second person and others contributing.

Bentley *v.* Brossard, (Utah) 94 Pac. 736, March, '08.

LODE AND PLACER LOCATIONS.

According to the United States Statutes, where the lode or vein within the limits of a placer location is excepted from the patent to the placer claim, such lode or vein and 25 ft. on either side thereof is open to exploitation and location by any citizen of the United States, for which purpose he is entitled to enter into possession.

Noyes *v.* Clifford, (Mont.) 94 Pac. 842, March, '08.

POSSESSION OF MINING CLAIM—PRESUMPTION.

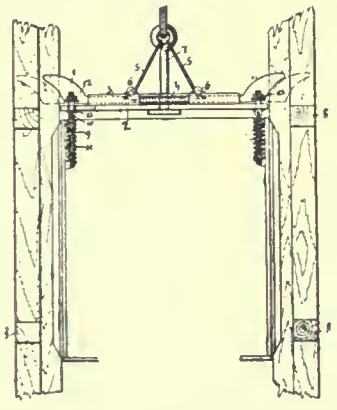
The mere possession and improvement, in the absence of other things, will give no value to a mining claim; their only force is to raise a prima facie presumption that the possession is rightful, and thus prevent the land being subject to original location as wild and unimproved land.

Ware *v.* White, (Ark.) 108 Southwest. 831, Jan., '08.

MINING AND METALLURGICAL PATENTS.

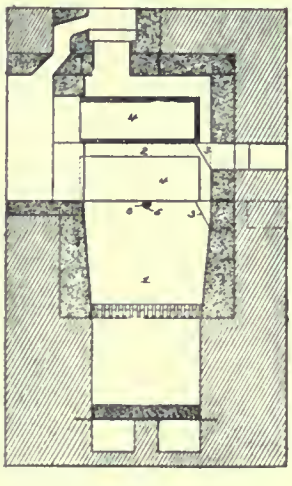
Specially Reported for the MINING AND SCIENTIFIC PRESS.

MINER'S CAGE.—No. 887,193. Heinrich Heiling, Daldrup, near Dülmen, Germany.

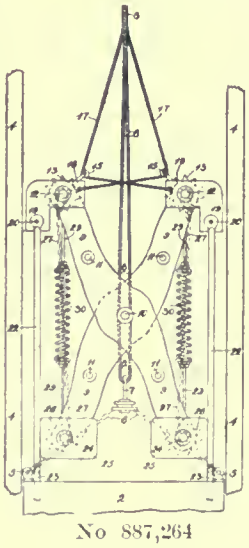


A safety device for miners' cages and lifts, comprising in combination with the shaft, the hoisting-rope, the drawing-rod, and the cage; a separate top for said cage, strong springs arranged to suspend said cage from said top, spring influenced bars connected to said rod and movably arranged on said top and adapted to be pressed outward within the reach of the transverse beams of said shaft upon the breaking of said hoisting-rope and having such a shape as to stand oblique to said transverse beams, and provided on the oblique sides with roughened surfaces, means to fix said top firmly to said cage when raising dead load, and means to prevent said bars entirely from moving when raising dead load, all for the purpose set forth.

ASSAY-FURNACE.—No. 887,057. Lafayette Baudendistle, Denver, Colorado.



No. 887,057



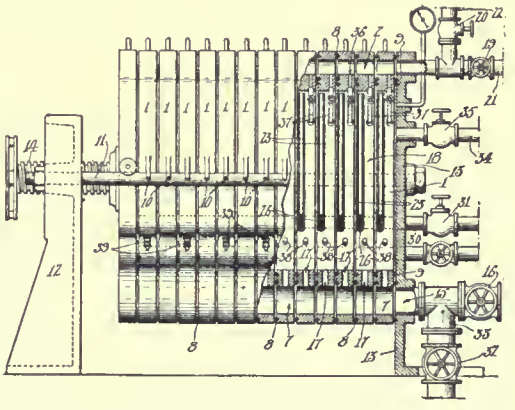
No 887,264

In an assay-furnace, the combination with means for supporting the ends of a muffle, of a pipe constituting a support for the muffle between the ends thereof, a supply pipe for a cooling medium communicating with the supporting pipe, a controlling valve in the supply pipe, and a check valve in the supply pipe between the controlling valve and the supporting pipe.

SAFETY BRAKE MECHANISM FOR MINE CAGES, SKIPS, AND LIFTS.—No. 887,264. Alfred M. Newman, Johannesburg, Transvaal.

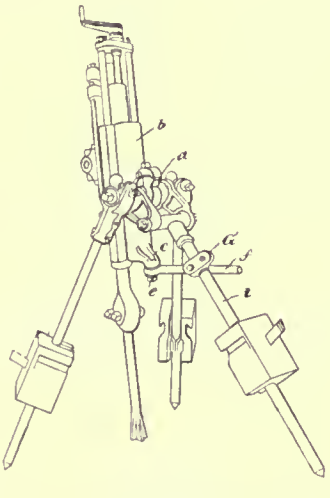
In apparatus of the nature specified, the combination with the vehicle of two pairs of levers pivoted at the centre and located at opposite sides of the vehicle, shafts carried by and between the extremities of said two pairs of levers, wheels mounted on said shafts, timbers with which the wheels are adapted to contact to arrest the movement of the vehicle on the breakage of the suspension gear, means for expanding said levers to cause the wheels to engage the timbers, and means operated by the wheels to further expand the levers to bring the vehicle to rest.

FILTER.—No. 887,285. Ernest J. Sweetland, Goldfield, Nevada.



In a filter, a series of frames each having a hollow ear at the bottom, means for holding the frames closely together, thereby forming a chamber with a conduit along the bottom, each ear having a port extending to the chamber, the frames also having hollow ears on either side of the bottom ears forming side conduits, filtering means in the chamber, and nozzles connected with said side conduits for discharging into the chamber at a point below the filtering means.

DRILL-SUPPORT.—No. 887,301. Albert Ball, Claremont, New Hampshire.



The combination of supporting legs and means to connect them at their upper ends, a drilling machine supported on said legs, a bracket projecting from the drilling machine and terminating in a spherical tip, a stay-rod having a cup-shaped end applied to said spherical tip and adjustably connected therewith, and a clamping device applied to one of the legs and performing the double function of fixing the adjustment of the stay-rod within the clamp and fixing itself in an adjusted position on the leg.

PROCESS OF TREATING IRON.—No. 886,668. Pearce Wilks, Dartmouth, Nova Scotia, Canada.

The herein described process of purifying or decarburizing iron, which consists in subjecting a pile of sheet, or scrap, iron to a welding heat in contact with slaked lime for causing a combination of the surface impurities of the iron with such lime, maintaining the iron at a welding heat in contact with slaked lime for a sufficient period to cause a progressive diffusion of the impurities from the interior of the iron to the previously purified surface thereof and a subsequent combination of the impurities with the lime in contact with the surface of the iron, and working the purified pile at a welding temperature to expel the lime and the impurities combined therewith.

MINE REPORTS.

GUANAJUATO CONSOLIDATED MINING & MILLING, GUANAJUATO, MEXICO.

The handsome report of the Guanajuato Consolidated Mining & Milling Co. for the fiscal year ending December 31, 1907, is no more elegant in the matter of paper, typography, and superb half-tone illustration, than excellent in the logical and explicit statement of fact touching every detail of mining and milling operations and financial results. It is essentially logical to begin a mining report with a statement of the year's development work in the mine, which is the index to the future. This statement is tabulated in such minute detail that, in conjunction with the elaborate maps accompanying the report, any stockholder may accurately determine the status of the mine. It appears that the total advance during the year has been 5271 ft. of work, including 475 ft. of shaft-sinking. The greater amount of work was done on level 6, amounting to 3255 ft., and 571 ft. of advance was made on level 7, these lower levels being almost wholly new. The outcome has been to reveal ore reported as 'blocked out,' classified by shoots, as follows: No. 1, level 5, 5250 cu. ft., or 350 tons for every foot of development work; San Francisco, between levels 6 and 7, 143,333 tons; San Faustino, 151,333 tons. Ore developed is reported in tons only when the blocks have been completely explored by drifts, cross-cuts, and raises. A new double-drum hoist and two 60-hp. motors for operating it have been installed at the Soledad station of the tunnel level, a new hoist has been installed on the San Francisco shaft on level 6 to facilitate the development of the ore-shoot below that level. A Gould triplex electric station-pump, as well as the Knowles electric station-pump, were equipped with new phosphor-bronze acid-proof fittings. A new Ingersoll-Sargeant air-compressor with a capacity of 1200 cu. ft. of free air per minute was also installed, with the necessary connections. Aside from these, very little additional equipment was provided. The supply of labor was scarce throughout the year, necessitating the introduction of mechanical appliances to a greater extent than formerly. The prevailing wage scale for the more common classes of labor was: helpers on machine drills, ₱2; hand-drillers, ₱1.05; shovelers, 75cv.; hoist-men, ₱1.50 to ₱2; skip-men, ₱1.25; timber-men, ₱1.25; track-men, ₱1.50; tool-sharpeners on machine-steel, ₱3, and on hand-steel, ₱2.50; trammers, ₱1; time-keepers, ₱1.50; watchmen, ₱1; and motormen, ₱1.75. Machine-drillers using hammer-drills were paid 15cv. per metre, and piston machine-drillers received ₱3 per day. The total ore mined during the year was 111,504 tons, of which 83,451 tons was delivered to the mill-bins. The ore was extremely uniform in grade, averaging 12.945 oz. silver and 0.057 oz. gold per ton, having a gross value of ₱1,606,776. The mill, consisting of 80 stamps, was operated 338 days and a fraction, the time-losses being due to power-off, 10 days; repairs, 11 days; and a strike, 6 days. The average stamp-duty was 3.13 tons per day through a 50-mesh screen. Concentrate produced was 2154 tons, equivalent to 2.54% of the total ore milled, having a gross value of ₱787,858, representing an extraction of 48.61% of the silver and 45.81% of the gold, or 48.21% of the gross value of the ore milled. There was cyanided 83,160 tons of concentrate sand-tailing, divided into 474 charges of 40,846 dry tons each, assaying 6.5 oz. silver and 0.059 oz. gold, with ₱9.62 per ton. The cyanide sand-tailing contained 2.099 oz. silver and 0.006 oz. gold, or ₱2.98 per ton. The slime-plant treated 42,620 dry tons, in charges of 34 dry tons each, assaying 7.026 oz. silver and 0.029 oz. gold, giving a value of ₱10.31 per ton. The slime-tailing assayed 2.154 oz. silver per ton and 0.006 oz. gold, or ₱2.94 per ton. The extractions were, therefore, from the sand, 68.97%, and from the slime 70.37%. It is to be noted that the actual bullion recovery was ₱582,607, which exceeded the theoretically indicated recovery to the extent of ₱2135.

The costs per ton at the mine were as follows: labor, ₱2.5321; patio (dump), 15.19cv.; crusher-plant, 23.42cv.; hacienda (including the items of dynamo-tenders, mechanics, blacksmiths, peones (common labor), electricians, carpenters, and firemen), 13.35cv.; general, 9.59cv. From the mine costs the following items of greater interest may be selected, namely, powder, fuse, and caps, 27.98cv.; electric power, 14.33cv.; air-drills and repairs, 5.98cv.; drill-steel, 2.04cv.; air-hose and connections, 0.25cv.; lumber, 0.59cv.; skips, 0.4cv.; and candles, 10.55cv. The grand total mine-expense was ₱4.4263 per ton. Development cost ₱1.0953 per ton. Total costs of crushing and concentrating were ₱1.2353 per ton, of which the chief items were: labor, 39.85cv.; supplies, 16.84cv.; electric power, 54cv.; assaying, 2.76cv.; and general expense, 3.29cv. The stamp-milling cost 14.82cv., the Wilfley tables 16.29cv., and the vanners 0.38cv. per ton of total ore milled. Failure to credit each kind of concentrator with its corresponding duty prevents a comparison of costs per ton of material treated on each. The cyanidation cost ₱3.66 per ton, of which slime-tank operation cost ₱1.08, and the sand-tanks 93.99cv., and the precipitation 41.22cv. The total cost was therefore ₱10.41 per ton of ore treated. The company is capitalized at $3,000,000, and has outstanding 7% debenture bonds amounting to $140,900, and 6% mortgage bonds of $42,400. The cash available is: 7% bond redemption reserve sinking-fund, $8588; surplus, $15,000, and undivided profit, $5609. A unique feature of the report, which is worthy of general imitation by mine managers, is a chart constructed on the same plan as a mill flow-sheet, showing distribution of staff and labor, thus accounting for every employee and revealing graphically his post of duty. To this is joined a tabular summary of the labor distribution, from which it appears that there were employed per day 31 Americans and 961 Mexicans.

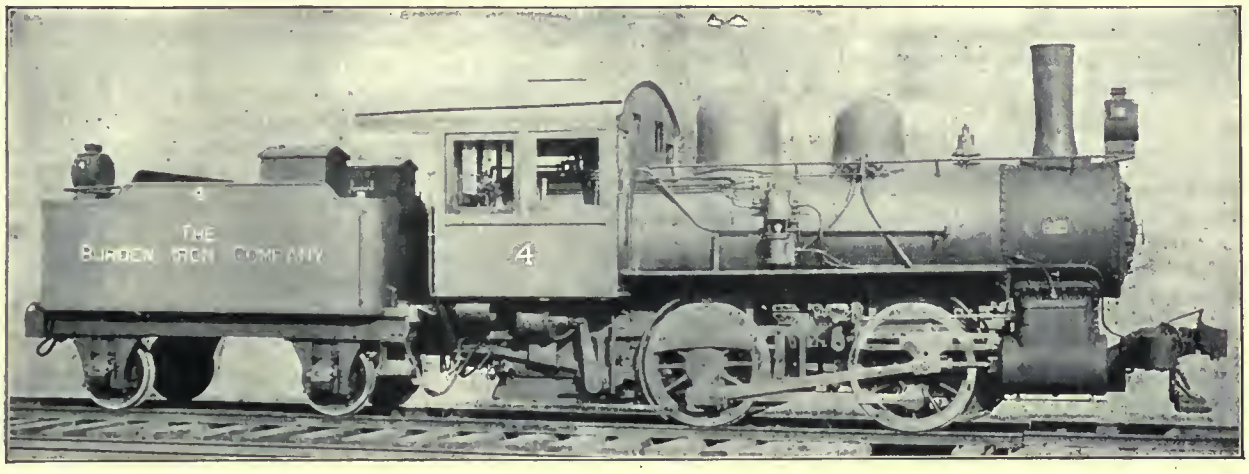
THE EXPLORATION CO., LTD., LONDON.

The report of the Exploration Co., Ltd., for the year 1907 shows a debit of £32,458, from which is to be deducted £19,882 brought forward from the previous year, leaving a debit balance to profit and loss account of £12,576. The directors offer as apology for this unfavorable outcome, which is accompanied by a shrinkage of the market prices of its investments amounting to £158,418, the "serious and universal depression in securities of every class during the past twelve months, and to losses sustained on realization of various investments. The market depression affected the value of practically all the company's investments, and especially of the shares in copper-producing companies referred to in the previous report, which were responsible for £85,000 of the above depreciation." The investments referred to were made on the basis of a selling price for copper of about £65 per ton, so that the directors look for resumption of profits from this source. The statement is made that the development of the Maravillas copper mine, in South America, did not give the hoped-for results, and the option has been abandoned after an expenditure of £18,428. The company has been disposing of its South African mining shares, but retains its Mexican interests. The Somera Gold Mining Co., Ltd., has been absorbed on terms satisfactory to both parties. The El Oro., Ltd., has proved of great value. The reduction works were completed in October last, and a first dividend may be expected during the first half of 1908. The Tomboy Gold Mines Co., Ltd., continues to earn large profits, and the developments are eminently satisfactory.

Criticism of the disastrous results of the year's operation has been severe, and charges of incompetency were freely brought against the directorate. Notwithstanding this, the old board was re-elected, and is given a chance to redeem the financial position of the company. The El Oro mine has just arrived at the productive stage, and recent developments are showing large bodies of high-grade ore in depth. Another large Mexican gold property will also be added to the list of investments within a short time. The sale of shares in the Transvaal mines is explained on the basis of doubt as to the treatment foreign companies may receive under the self-governing colony as constituted through the efforts of the late Sir Henry Campbell-Bannerman.

SWITCHING LOCOMOTIVE.

The accompany illustration shows the general appearance and design of a four-wheel switching locomotive with four-wheel tender recently built by the American Locomotive Co., of New York, for the Burden Iron Co. This engine is intended for switching service in the yards of the above mentioned manufacturing company, and represents the builders' standard 16 by 24-in. cylinder four-wheel locomotive with separate tender. Within the past few years the American Locomotive Co. has been standardizing its small locomotive designs, and as will be seen from this design,



has been particularly well worked out for the service for which the engine is intended, and is an excellent one for service where light rails, poor road-bed, and short curves are among the conditions.

The cylinders are 16 in. diam. by 24-in. stroke, and are actuated by Richardson balanced slide-valves. The total weight in working order, all of which is of course on the driving wheels, is 85,000 lb. With a boiler-pressure of 180 lb. and driving-wheels 50 in. diam., this engine has a maximum tractive power of 18,800 lb., which, using the usual figures for resistance on the level and 20 lb. per ton for 1% grade for grade resistance, gives this engine a net hauling capacity, exclusive of locomotive and tender, on a 1% grade of 640 tons, and on a 2% grade of 330 tons. With 18,800 lb. of tractive power it will be noticed that the weight on drivers gives a factor of adhesion of 4.52, which is an excellent figure for an engine of this type, designed for switching or industrial purposes. With a wheel-base of 84 in., this engine will easily negotiate a curve of 65 ft. radius.

A careful study of the principal dimensions will show that particular attention has been paid to securing the proper ratios between heating surface and grate-areas, and heating surface and cylinder-volume. With 85,000 lb. on drivers, the engine has a load per wheel of 21,250 lb., which can easily be carried on a 60-lb. rail. In this design the tender, which is of the U shape flat top type, has a water capacity of 2500 gal. and a fuel capacity of 3 tons of coal. The tender-frame is built of steel channels.

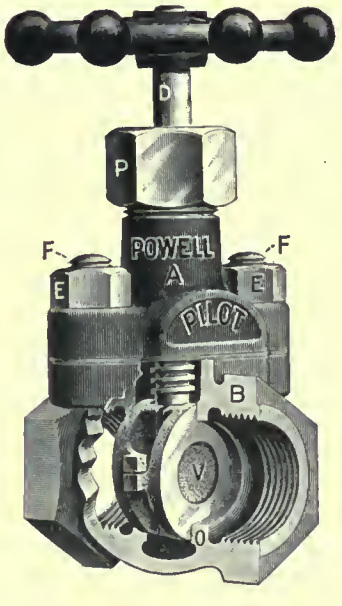
A wood-burning stack could be easily applied to this engine and would make the design (with weight all carried on drivers, large factor of adhesion, short driving-wheel base and ample water and fuel carrying capacity) very well adapted for logging service and similar work near mines.

PORTABLE ASSAY OUTFIT.

A compact, easily transportable apparatus for making assays of the common metals which shall have a close approximation to the accuracy of refined analytical methods, has long been needed. Prospectors have struggled with blow-pipe outfits, which are useful when minerals of any size can be obtained, but which are valueless for the determination of the quantities of gold, silver, copper, or lead in ores which would be of commercial importance, and engineers have resorted to home-made kits of limited applicability for carrying into the field to guide them in reconnaissance, which have only partly fulfilled their purpose. Recognizing the need of a portable assay laboratory which would yield actual quantitative results, L. M. Pritchard has arranged a series of simple methods, with appropriate reagents and apparatus, in compact form, which it is claimed will enable extremely accurate analyses to be made of ores of gold, silver, copper, and lead, by persons of ordinary intelligence who can follow the simple instructions given. Mr. Pritchard claims accuracy which will check up closely with the work of chemists in well-equipped laboratories, except when the metallic content in the ore is very large. A trace of gold is indicated as certainly as by the fire assay. These outfits are put up by the Prospectors Supply Co. of Los Angeles in different sizes, the largest, equipped for 200 assays of the four metals named, weighing only 24 pounds.

GATE-VALVE.

The Pilot iron body gate-valve is another addition to the already long list of steam specialties manufactured by the Wm. Powell Co., of Cincinnati. The illustration shows a strong compactly built valve with every detail carefully worked out. The iron body is built for service and is de-



signed with heavy lugs on either side of the neck, carrying stud-bolts F; the bonnet cap A has corresponding lugs drilled to template, which insures a perfect fit and constant alignment at all times, and also allows the bonnet to be replaced without unusual care after being taken apart for inspection or repairs. Two semi-finished hexagon nuts E, large enough to admit wrenching down hard, with a joint of the best packing material between the faces of bonnet and body, make an absolutely tight joint for all pressures

up to 100 lb. Note the large brass packing nut, P, affording plenty of room for packing material to prevent leakage around the stem. The brass stem, D, and bonnet are chased and cut to a true Acme thread of unusual length, the best for wear. The length of thread keeps the stem in a true axial position at all times, whether open or closed. The knobby hand-wheel gives a firm grip, even though the hands may be oily. The discs are double, not a single wedge, with ball-and-socket back, making them adjustable. They are hung in recesses to the collar on the bottom of the stem. The discs, working in a tapering seat, expand or collapse in opening or closing, making a valve that will close down tight without straining or open easily, no matter what the conditions may be. This all-iron Pilot gate-valve will be found especially valuable in controlling ammonia, cyanide solutions, acids, and all other liquids or gases that attack brass.

BOOKS RECEIVED.

MINES AND MINERALS OF THE BRITISH EMPIRE. By Ralph G. Stokes. 8vo., 396 pp. Ill. Index. Edward Arnold, London. 1908. Price $4.20. This is an attractive and well printed volume by a young journalist who has traveled in the different mining regions under the British flag. He is favorably known as a contributor to the technical press. A large amount of useful information is collected within the space of this book, and it is offered in a presentable manner. The illustrations are on glazed paper and are excellent. The reading matter is on dull paper and is well printed. The author, besides giving a handy book of reference, has discussed many economic problems in an interesting way, so that the book will commend itself to the mining engineer desirous of keeping himself well informed.

A DICTIONARY OF SPANISH AND SPANISH-AMERICAN MINING AND METALLURGICAL TERMS. By Edward Halse. 8vo., pp. 380. Chas. Griffin & Co., London. 1908. This is a handy dictionary, of convenient size, clearly printed in bold type, on good paper. It is the most complete collection of Spanish words and phrases that has yet been prepared with definitions in English, and the system of cross-references makes it easy to trace out the significance of technical or colloquial mining phrases from any word serving as a key. For example, 'a coil of fuse' can be found whether called a *rueda de mecha*, or *rollo de guia*, by reference to either of the four nouns, any one of which will lead to all the others. Similarly the various expressions for 'open-cut work' are traceable, whether the key-word used as the starting point be *tajo*, *cielo*, *cantera*, or *labor*. It will be an invaluable assistant for anyone engaged in Spanish-American mining or metallurgical operations. For sale by the MINING AND SCIENTIFIC PRESS.

DECORATION OF METAL, WOOD, GLASS, ETC. By H. C. Standage. Pp. 228; index. John Wiley & Sons, New York. 1908. Price $2. For sale by the MINING AND SCIENTIFIC PRESS.

This is not an ordinary book of household recipes for renovation, but a brief clear statement of how the finishing and decorating of metal, wood, and so forth, are done by the skilled artisan, with formulas for all substances employed. It would be useful to the master-workman as a handy reference book, to manufacturers, and to those who have a passion for keeping things spick and span. As an example of the field covered, a few items will suffice, such as bronzing, metallic coatings, dips, stains, enamels, and vitrous glazes, preparation of luminous paper, etching metals, lacquers and japanning, and polishing wood.

THE ARCHITECT AND BUILDER'S POCKET-BOOK. By Frank E. Kidder. 15th ed., pp. 1703. Ill. John Wiley & Sons, New York. 1908. Price $5. For sale by the MINING AND SCIENTIFIC PRESS.

The chief improvements in the new edition of this well known and invaluable hand-book consist in a new chapter on re-enforced concrete by Rudolph P. Miller, the editor, who has succeeded the late Frank E. Kidder. The chapter on fire-proofing is more than half new, and is thoroughly in accord with most recent practice. Mr. Miller speaks with authority on this subject, having been chief engineer of the Department of Buildings in New York City for the past five years. The regulations which he was instrumental in drafting for that department have constituted the basis of those adopted by the large cities throughout the United States.

PUBLICATIONS RECEIVED.

We have received the following Bulletins from the U. S. Geological Survey: No. 327, 'Geological Reconnaissance in the Matanuska and Talkeetna Basins, Alaska,' by Sidney Paige and Adolph Knopf; No. 329, on 'Structural Materials Testing Laboratories at St. Louis, Mo.,' by R. L. Humphrey; No. 331, 'Portland Cement Mortars and their Constituent Materials,' by R. L. Humphrey and William Jordan, Jr.; No. 333, 'Coal Mine Accidents, their Causes and Prevention,' by Clarence Hall and W. O. Snelling; No. 334, 'The Burning of Coal Without Smoke in Boiler Plants,' by D. T. Randall; No. 336, 'Washing and Coking, Tests of Coal, and Cupola Tests of Coke,' by Richard Moldenke, A. W. Belden, and G. R. Delamater; No. 339, 'The Purchase of Coal under Government and Commercial Specifications on the Basis of its Heating Value,' by D. T. Randall.

COMMERCIAL PARAGRAPHS.

THE WOOD DRILL WORKS, Paterson, N. J., have issued a circular describing their rock-drill.

THE MINNEAPOLIS STEEL & MACHINERY CO. has moved its San Francisco office to room 716 Chronicle Bdg.

THE RAND DRILL CO. have recently put on the market a new type of pneumatic hammer, which is well adapted for welding stamp-stems.

THE PELTON WATER WHEEL CO., San Francisco and New York, has issued bulletin No. 4, describing Pelton water-wheels and accessories.

THE MCLAUGHLIN MFG. CO. announces the sale of two of the new McLaughlin traction engines for use in the haulage of heavy lumber and mining timbers.

CHALMERS & WILLIAMS, Chicago, have lately closed a contract with the Croesus Gold & Copper Mining Co., Hailey, Idaho, for a complete Huntington mill plant.

SULLIVAN MACHINERY CO. has issued catalogue No. 61, describing stone-channeling machines, and bulletin No. 58-D, on Corliss straight-line air-compressors.

ARTHUR KOPPEL CO. have recently received an order from the City of St. Louis for 18 special, standard gauge, 80,000-lb. capacity garbage cars, and another large order for standard 12-yd. cars.

THE GENERAL ENGINEERING CO., Salt Lake, Utah, have issued a pamphlet which they call 'Ore Testing Bulletin,' describing their laboratory and methods for the predetermination of ore processes. Several pages of tables and useful data are included.

THE LUNKENHEIMER CO., Cincinnati, Ohio, has recently issued its 1908 catalogue, which it is willing to send, free of charge, to anyone interested. The book comprises 500 pages descriptive of its line of engineering specialties, and 60 pages of tables and useful data.

D. C. DEMAREST, lately associated in the management of the Angels Iron Works at Stockton, Cal., has retired from active association in this work and opened engineering offices in the Hooker & Lent Bdg., 503 Market St., San Francisco. Mr. Demarest will give his entire time to the design and sale of mining machinery.

BYRON JACKSON IRON WORKS announce the shipping of a complete patent suction gold dredge to the Kievicz Mining Co., at Fairbanks, Alaska. This dredge, which is similar in design to the Dubois dredges now operating on the Sacramento and American rivers in California, has been particularly built for the conditions to be found on the Tanana river, where it will be operated.

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Editorial.

PAYMENT FOR BULLION deposited at the United States mints and assay offices in the Western States will not be made in Eastern exchange after June 10. The practice of issuing New York drafts for bullion deposits has resulted, since the Spanish war, in accumulating in the San Francisco mint $300,000,000, of which $240,000,000 is gold. The only outlet which the Western mint has for its specie is through the demand for coin or bars by depositors, and through the payment of warrants issued by the Treasury Department.

REPORTS of the discovery of gold in the Anadir district of Siberia are appearing in the daily press and will revive the hopes of profitable mining on the Asiatic side of Bering Sea. Several expeditions have failed to find rich gravel across the way from Nome and the Russian officials have made the most of concessions from which they expected to gain. News of discovery should be accepted with caution. We shall be glad to find the information true.

AT SEATTLE, the Northwest Mining Men's Convention has been in session, under the presidency of Mr. A. W. McIntire, formerly Governor of Colorado. Resolutions were passed endorsing the creation of a Bureau of Mines in the Department of the Interior, the preservation of natural resources, the revision of the mining laws, and the prevention of fraud in mining, but the most interesting resolution was that protesting against the oppressive rates on traffic to and from Alaska and the ports of the Northwest.

PENNY POSTAGE between Great Britain and America will be in effect next October. This is a most important reduction in the cost of communication by mail and will stimulate business across the Atlantic. It is well known that this much desired reform would have been effected long ago save for the opposition from Canada, where penny postage has been in force, to the advantage of commercial relations with the mother country. Eventually we hope to have the same minimum rate throughout the Postal Union.

THE YAQUI rebellion, in Sonora, appears not to be ended yet. With characteristic indifference to truth, the newspapers announce one day that hostilities have ceased, only to narrow it down the next to negotiations with a single chief. It turns out that the news published in our regular Mexican correspondence on May 30 gave the facts five days before the same information reached the daily press through the medium of its telegraphic service. It is to be hoped that the Indians will make peace, however,

without suffering the hopeless struggle to be prolonged. This war was incited by graft, it has been perpetuated for the sake of graft, and a rich country has been kept from benefiting either the native or the foreigner. With the advent of the railroad the pressure of civilization is rendering it impossible for either the grafters or the Yaquis to continue the state of affairs that has existed for so many years, and if the Indians do not lay down their arms the troops will probably at last make an effective campaign against them. The region involved is rich in gold, silver, and copper. At Fundicion, on the edge of the district, the smelter of the Douglas Copper Company was blown in two weeks ago.

Valuation of Mining Shares.

WHAT mining school will be first to recognize that applied science must be economic science and that it will never be allowed to cumber the affairs of men by being uneconomic? Observe that economic science is not the science of economics. There is such a thing as applied science of economics also, and this needs to be added to economic applied science in the training of technical students to fit them for the proper exercise of their duty as leaders of a great part of the industrial movement of the age. The old struggle and mutual contempt of 'town and gown' still survives in a singularly large degree. The man on the street has not fully made up his mind to accept the college graduate as a safe person to be trusted with control of the engines of finance, and in spite of much cringing to capital and frank avowal of money-making purposes, the collegian, even of the technical sort, has not quite overcome the ancient academic arrogance which finds in commercialism a taint and a blemish. The question which the faculty of the technical school needs to put to itself is what special equipment it is giving its students to grapple firmly with the problems of plain business involved in the successful application of scientific knowledge. How may a student expect to understand the complicated problems of exchange, banking, and finance, if he is not instructed in them? The commercial school is assuming an ever greater importance in the preparation of young people for a business career. The day of apprenticeships has nearly passed. The trade unions have frankly abolished the system, and the commercial world is brushing it away. Men engaged in strenuous work under modern conditions have no time to be school-masters, and are impatient of the blunderings of inexperience. Time was when the mine accounts were a matter of ill assorted jottings in the manager's pocket memorandum book. The exaggeration of this statement would not have seemed so striking twenty years ago as it appears today. But the mining graduate goes forth to deal with the complications of mining finance with no more preparation than was given the student then, except in so far as every keen intellect gains some comprehension of the conditions of his era by absorption.

In our Discussion department last week Mr. Newton B. Knox gave an illuminating explanation of certain principles involved in estimating the true value of a mine. In this issue he is followed by an interesting letter from Mr. C. W. Purington. How many technical students are able to swing free from a theoretic scheme and apply sound principles of accounting to the solution of a special problem when a client demands guidance in the financial plans which the conditions of the enterprise impose upon an honest and conservative board of directors? It is time that technical schools should recognize the need of establishing chairs of financing and accounting to better equip young men to meet the responsibilities of practical life, and to win success without struggling against the disadvantages of that sort of apprenticeship which in all branches of human endeavor is becoming obsolete, and hence more difficult to acquire after entering upon an active career in the field.

Manufacturing Good Times.

PRESS dispatches declare with a big flourish that the financial stringency is being waived by the railroads. In exact quotation: "The official announcement that the Illinois Central has decided to ignore what remains of the financial depression is likely to set the pace for other large systems which have been withholding similar orders until the conditions are fully normal." This is all with reference to the action of the Illinois Central Railroad in placing an order for 52,000 tons of steel rails, to cost $1,456,000. The joke is that Mr. Harriman's Illinois Central Railroad places its splendid order with Mr. Harriman's Tennessee Coal & Iron Company. This is heralded to a credulous public as an example of courage and magnanimity in a corporation determined to conquer hard times by stimulating industry for the general good. We have no quarrel with a man who uses such prosperity as his railroad may possess to save depreciation and loss in his steel plant. Idle machinery deteriorates: closed doors drive away skilled labor: each enterprise has its separate responsibilities and obligations. Hence the one-man influence exerts itself in the direction of self-preservation when it employs one enterprise to feed another: in so doing the welfare of many is served, and a restoration of normal financial conditions may thereby be promoted. But it is pitiful to note how the Associated Press counts upon the ignorance, or forgetfulness, or mock-earnestness of the public. The purpose of such misleading statements as the one quoted above is plain enough. The great corporate interests work in pleasant accord, and the press is harmonized with the traffic and commodity monopolies, so that news is constantly colored to lead the people to conclude what it is desired that they should believe. It is worth while now and then to be reminded of bondage lest we forget entirely what our condition is. In spite of ourselves, this continual soaking in lies, in misrepresentations of truth, and in distortions of fact, results in absorption of false impressions, and our judgment becomes clouded when we try our hardest to see straight and true. We all desire a return of prosperity, but we do not wish a see-saw of confidence, so that when depleted stocks compel resumption of large production in various branches of industry, the general

public will have been further impoverished by the relentless spoliation of market manipulators. Speculation thrives upon credulity, not upon knowledge, and the men who take up the shout that the big corporations are 'waiving' the financial depression are those who lay wisdom and caution aside, and swell a 'wave' of dollars to break on the beach of Wall Street for the benefit of the piearoons infesting that dangerous coast.

Devious Ways.

THE steam-heated imagination of Mr. Lawson will be working over-time in the near future, for he has been given an option on the Guggenheim holdings of stock in the Nevada Consolidated, Cumberland & Ely, Steptoe Valley, Utah Copper, and other corporations working copper mines in Nevada and Utah. This option has five months to run, so that the bombardment of the public intelligence by the Boston filibuster is expected to begin at any moment. In a recent issue of our New York contemporary there is a reference to the Copper Mines Company, a consolidation with $60,000,000 capital that is to absorb the enterprises above mentioned, but *The Engineering and Mining Journal* is misinformed: the scheme for merging the Nevada Consolidated with the Cumberland & Ely, and the further merging of these properties with those of the Utah Copper, and the Steptoe Valley companies, has been set aside, probably because it was known that the minority interests would fight vigorously and effectively against a watering process that would have turned a copper vintage of high quality into the *vin ordinaire* of a diluted stock merger. The Guggenheims own a dominant interest in a number of copper companies, operating mines, mills, and smelters in Utah and Nevada; they own only a bare majority, or a working majority with financial friends, in the best of these enterprises, while owning nearly all the stock of the poorer undertakings; therefore a consolidation would have impaired the individual value of the separate properties and enhanced the price of the poorer at the expense of the better stocks. There has been talk of some such Wall Street prestidigitation for many months; the formation of a holding company to own the shares of the Guggenheims and their associates is the alternative finally chosen. It is a clever move. Obviously, the effect will be to lessen public interest in the shares of the separate companies, and hence to depreciate them, by focussing attention on the consolidation of majority interests, the shares of which will have greater stability than those of any single enterprise. The gravity of wealth is at least as remarkable as the falling of the apple that caught Newton's eye. And apart from this aspect of the case, the episode has a deeper significance. It is another example of the manner in which obligations, responsibilities, and laws can be evaded by the up-to-date financier. A corporation owning the stock-holdings of a group of men is a legal entity as devoid of character as a meteorite, as amenable to public opinion as a horned toad. It is simply a beautiful device for juggling the stock-market. We regret—and this is no figure of speech—that the Guggenheims, so honorably and for so long prominent in the business of mining and smelting, should have turned their clever hands from industrial operations of a highly useful kind to stock manipulation of an utterly pernicious character. If anyone can lead them down a steep place into the sea, it is Lawson; whatever few millions they may win by the medium of his buffoonery and bunco-steering, they will lose in other ways. Already their credit has suffered by the Yukon fiasco; the stock the public foolishly bought at 8 and 9 dollars is selling for less than $4, and Lawson's flamboyant rot was unable to create a market for a much over-capitalized, though meritorious, mining scheme. Even should the Guggenheims make two or three millions by the further assistance of Lawson, their financial credit will suffer by more than twice the amount filched from the pockets of the public by means of the frothy advertisements of a pseudo-reformer and irresponsible pamphleteer.

Mexican Banking.

THE Mexican banking law has just been modified in many important respects. That which especially challenges attention is the great increase in capital required for banks of issue, which has been raised from one hundred thousand to a minimum of one million pesos. It is clear that Sr. Limantour, the minister of finance to whom these reforms are chiefly due, intends that there shall be no departure from the purpose of the old law. The Mexican banking system was based essentially on the Scotch principle of strong central institutions, serving the needs of smaller centres through branches and agencies. Industrial development in Mexico during the recent years of extraordinary business activity tended to stimulate the establishment of many banks. The law as now altered puts a check on reckless incorporation of banks and regulates the financial currents within the Republic. A community may subscribe capital to a *sucursal* or branch of some large bank, thus in a measure making it a local enterprise, for the branches operate on capital of their own, but they are tied to and controlled in their policy by the central institution. This makes for solidity and safety. The Mexican banking system has long been superior to our own; now it advances a step further on the road of conservatism, while we are inflicted with a patchwork bill, rushed through Congress in the last hours of the session against the protests of our leading bankers. Thus our system is complicated so that it is not understood by the people, and is viewed with suspicion by all classes save the few in whose interest it was constructed. Mexico feels the need of building up her strength, and she has a statesman in Diaz, and a financier in Limantour, to do it. We are strong, and rather inclined to a happy-go-lucky kind of legislation, confident that we can survive our errors. The statesman and the financier of the highest ability do not control national legislation. The inevitable result is to add to our difficulties in time of business depression through mistrust in the mechanism of our institutions of credit and exchange.

Personal.

JAMES W. NEILL is in town.

J. H. CURLE is in Tierra del Fuego.

F. J. H. MERRILL has gone to New York.

HARRY S. DERBY has returned to Colombia.

MARK B. KERR has gone from Bodie to Tonopah.

LIONEL LINDSAY has returned to London from Spain.

GAYLORD WILTSHIRE has returned from British Guiana.

ROBERT SCHORR arrived in New York from Europe on May 21.

RALPH NICHOLS recently visited the copper country of Michigan.

W. H. SHOCKLEY is here, on his return from southern California.

E. H. MESSITER has returned from British Columbia to New York.

EDMUND JUESSEN was in San Francisco, on his way to Portland, Oregon.

BENJ. B. THAYER has been elected a director of the Amalgamated Copper Company.

C. L. DIGNOWITY, of Reno, Nevada, has been spending a few days in San Francisco.

C. L. WHITTLE, of Boston, is examining mines at Rollin, in Siskiyou county, California.

F. H. MORLEY, of Denver, has gone to Chihuahua, Mexico, and will be there for two months.

ALFRED FRANK has been appointed manager for the Davis-Daly Estates Copper Co., at Butte.

F. F. SHARPLESS, of the Consolidated Mines Selection Co., has returned to New York from Mexico.

PHILIP READE BRADLEY has sailed for British Guiana, where he is manager of the Peters mine.

EDGAR E. WARREN has left London for Spain, where he is about to open up mines on his own account.

T. A. RICKARD will visit the principal goldfields of Alaska, sailing from Seattle about the middle of June.

T. H. LEGGETT and FREDERICK HELLMANN will make an examination of the copper mines at Ely, Nevada.

J. E. SPURR and J. H. FARRELL are making a geological survey of the Camp Bird mine, at Ouray, Colorado.

F. W. BRADLEY has gone from Wardner, Idaho, to the Alaska-Treadwell mine, of which he is consulting engineer.

FRANK H. MASON has resigned as manager for the Johnston-Graham Mining Co., and is now at Paso Robles taking a rest.

JOSEPH P. GAZZAM, who has been supervising the erection of a dredge in Mariposa county, California, has returned to St. Louis.

D. T. WILLIAMS, for many years chemist to Elliotts Metal Co., South Wales, has opened an office and laboratory at 42 Finsbury Square, London.

WILLIAM A. HEYWOOD has opened an office at 4 Broad St. Place, London. He has gone to Chile, as consulting metallurgist to the Copiapo Copper Company.

OBITUARY.

J. F. O'GORMAN died in Mexico on May 17. He came originally from Dublin, and had resided in all parts of the world, representing various mining companies. For the last three years he had been installing an elaborate water-power plant near Choix, Sinaloa, in connection with a smelter project.

LEMUEL U. COLBATH, aged 76, died at Salt Lake on May 26. The deceased was one of the veteran mining men of the West, having operated on the Mother Lode of California in the early days; he later went to the Comstock, and thence to Utah, where he became actively identified with the development and management of the Ontario Silver mine, at Park City.

Latest Market Reports.

LOCAL METAL PRICES—June 4.

Antimony	12@16c	Quicksilver (flask)	$45@45.50
Casting Copper	14¼@15¼c	Spelter	6½@ 7¼c
Pig Lead	4.75@ 5.70c	Tin	32½@34c

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date	Electrolytic Copper	Lead	Spelter	Silver
May 29	12.56	4.35	4.58	53
" 30	Legal holiday. No market.			
" 31	Sunday. No market.			
June 1	12.56	4.35	4.58	53
" 2	12.63	4.35	4.55	52⅝
" 3	12.63	4.35	4.53	52¾
" 4	12.63	4.35	4.53	52⅝

ANGLO-AMERICAN SHARES.

Cabled from London.

	May 28. £. s. d.	June 4. £. s. d.
Camp Bird	0 13 0	0 13 0
El Oro	4½	1 4 6
Esperanza	1 6 3	1 9 0
Dolores	1 5 0	1 5 0
Oroville Dredging	0 11	0 11 6
Stratton's Independence	0 1 7	0 1 6
Tomboy	1 12 6	1 15 0

(By courtesy of W. P. Bonbright & Co., 24 Broad St., New York.)

MINING STOCK QUOTATIONS—NEW YORK.

	Closing prices. May 28.	June 4.
Amalgamated Copper	63¼	65¼
American Smelting & Refining Co	72⅝	73½
Boston Copper	11⅛	11⅜
Butte Coalition	22½	23¼
Cumberland Ely	7¾	7⅞
Dolores	6½	7
El Rayo	1⅞	1¾
Giroux	3	3¼
Greene-Cananea	9⅜	9⅝
Indiana Sonora	4¼	4½
Miami Copper	4¾	5
Micmac	3½	3⅝
Nevada Consolidated	11¾	11⅞
Newhouse	7⅜	7
Nipissing		7¼
Ohio Copper	2⅜	2½
Tennessee Copper	36⅛	37⅛
Utah Copper	30⅞	30½
Yukon	3¾	3⅞

(By courtesy of Trippe & Co., 25 Broad St., New York.)

SOUTHERN NEVADA STOCKS.

San Francisco, June 4.

Atlanta	$ 18	Laguna	1.00
Belmont	87	Manhattan Con	10
Columbia Mtn	16	Midway	37
Combination Fraction	46	Montana Tonopah	1.47½
Daisy	90	Nevada Hills	2.10
Fairview Eagle	50	Rawhide Queen	1.70
Florence	3.22½	Sandstorm	24
Gold Bar (Bullfrog)	6	Silver Pick	15
Goldfield Con	5.30	St. Ives	29
Gold Kewanas	27	Tonopah Extension	83
Great Bend	27	Tonopah of Nevada	8.05
Jim Butler	26	Tramp Con	16
Jumbo Extension	27	West End	42

(By courtesy of W. C. Ralston, 353 Bush St.)

COPPER SHARES — BOSTON.

	Closing prices. June 4.		Closing prices. June 4.
Adventure	2¼	Michigan	8½
Ahmeek	70	Mohawk	58
Allouez	27½	Nevada Con	12
Amalgamated	65¼	North Butte	65½
Arcadian	3½	Old Dominion	35¼
Atlantic	16	Osceola	90
Bingham Con	50	Parrot	21¼
Boston Con	11¾	Phœnix	50
Butte Coalition	23½	Quincy	85
Calumet & Arizona	106	Rhode Island	3
Calumet & Hecla	675	Santa Fe	1¾
Centennial	23	Shannon	13⅞
Con. Mercur	40	Superior & Pittsburg	12
Copper Range	72½	Tamarack	59
Daly-West	10	Trinity	13½
Franklin	8¾	United Copper com	7
Granby	98½	Utah Copper	30¼
Greene-Cananea, ctf	9⅝	Victoria	5⅜
Isle Royale	18½	Winona	6
Mass	3	Wolverine	133

General Mining News.

ARIZONA.

COCHISE COUNTY.

Clark & Scanlon have sold a group of five claims in the Copper Creek mining district, 75 miles north of Benson, to Manager Sibley of the Copper Creek Co. It is claimed that there is a vein 10 ft. wide which assays 14% copper, 27 oz. silver, and $5 gold.——The 80-stamp mill at the Pierce mine is running only half-time.

MARICOPA COUNTY.

The Relief mine has closed down for two weeks on account of shortage of water.——The Monarch M. & S. Co.'s new mill, nine miles east of Wickenburg, is to start soon. The mill has a capacity of 50 tons, and replaces the 35-ton plant destroyed by fire last May. When the mill is in operation the force in the mine will be increased.

MOHAVE COUNTY.

A company of Butte men has taken a bond on the Emerson mine, at Chloride.——J. J. Connolley and others have taken a lease on the Little Flores mine, at Cerbat, and are to unwater the property and begin work at once.——The Utah-Arizona Gold Mining Co. has purchased the 5-stamp mill of the old Suncloud Mining Co., at Signal, and will move it to the property of the company in the Weaver district.——The Elkhart mine, at Chloride, has been sold to a company of Eastern men, who will develop and work it at once.

SANTA CRUZ COUNTY.

(Special Correspondence).—The Saleros Mines Co., operating in the Tyndall district, is making extensive preparations for active mining. The ground has been thoroughly prospected with a diamond drill. A wagon road from Patagonia, a distance of 12 miles, is now under construction. The company will sink a 500-ft. shaft in the Darwin claim and drive an adit in the Eureka. The ore bears silver and copper.——It is reported that the Gringo mine, in the Tyndall district, will install new and heavier machinery and will double the capacity of the present 10-stamp mill. The shaft is now 500 ft. deep.

Patagonia, June 1.

CALIFORNIA.

INYO COUNTY.

The two-compartment shaft of the Bishop Creek Gold Co. has reached a depth of 50 ft. A new hoist and a Leyner drill have been installed. The diamond drill which is working in the canyon recently struck at 150 ft. two feet of sulphide ore which assays $34 per ton. This hole is over 200 ft. from the first, in which similar ore was found.——The Southern Belle mill is running on ore from the Bullion, which is being taken out by the tramway in the New York adit. Eight miners are stoping in the 325-ft. level of the Bullion.——A contract has been let to advance the Index adit, near Pine Mtn., 350 ft. farther. It is expected that three veins will be cut before the Bull Domingo is reached.

NEVADA COUNTY.

(Special Correspondence).—Another bed of rich gravel has been encountered on the Weare claim, near Banner Mtn. Blair & Tregonning of this city have decided to purchase the property and operate it on an extensive scale. ——A promising gravel channel has been struck by Joseph Weaver on the Fowler ranch, on the south slope of Banner Mtn.——The company owning the Conlan mine has decided to resume operations. Sufficient money has been raised by the stockholders to carry on the necessary developments. ——A force of men has been put to work in the lower levels of the New York-Grass Valley mine. From $1500 to $2000 will be expended monthly in developments.——Work has been resumed at the Midas mine, after a brief shut-down. ——Nevada City parties have obtained a bond on the Mt. George claims, at Indian Flat, and will sink the shaft 150 ft. Three shifts will be employed.——A cave occurred in the lower level of the Yuba mine last week. A miner was seriously injured. Little damage resulted to the mine.—— The Champion mines at Nevada City have suspended operations for an indefinite period. Considerable ore is blocked out in the lower levels but it proved of too low a grade to mine profitably. The group was under option to an English syndicate and its closing means a heavy blow to the prosperity of the town.

Grass Valley, June 1.

SHASTA COUNTY.

The Balaklava mine has resumed, employing 30 men.—— The Mountain Copper Co. is again doing its own diamond-drilling, the recent contract with the Arizona Diamond Drill Co. having expired. The work now being done is confined to the Hornet claim.——The Gladstone mine, on French gulch, has been capitalized by its owners for the purpose of raising funds for extensive development and equipment.

SIERRA COUNTY.

A company of Colorado men has taken a bond on the old Colombo mine and will open it at once. They have also a 30-day working option on the Eley mill, in Jim Crow canyon, and have a force of men at work preparatory to a test run.——Dolan & Bell have resumed work at the Gum Boot mine, in Slug canyon.

On the Sierras.

SISKIYOU COUNTY.

Welch & Sons have started their hydraulic elevator, on Grouse creek, and are using three giants.——The old mill at the Mattern mine has been purchased by Varley & Fowler, who have moved it to their Quartz Valley property.—— The Elk Creek Mining Co., on Canal gulch near Hawkinsville, made a clean-up of $1500 after a 20-day run with a 2-stamp mill.——The Wood Rat bar, on the north side of Klamath river, between Ash and Humbug creeks, has been bonded to a company of Cleveland (Ohio) capitalists who will begin operations at once.

TUOLUMNE COUNTY.

The Tuolumne Water & Power Co. is extending a transmission line from Jamestown to supply power for the Omega mine.——A shaft is being sunk on the Brunson ranch, near Keystone. The incline shaft of the Joe Hooker, on the Calder ranch, has been cleared and will be deepened. ——The Philadelphia is building a ditch to carry water to its gravel property above Columbia.

COLORADO.

CLEAR CREEK COUNTY.

(Special Correspondence).—A bonanza strike has been made in the Capital mines. In starting a new raise between the fourth and fifth raises on the west drift of the Aetna vein, 15 ft. of ore has been exposed, which assays as high as 30 oz. gold per ton. Running through the main body are a number of streaks of rich ore containing free

gold. This is one of the most important strikes ever made in Clear Creek county, for the reason that it occurs at a vertical depth of 1700 ft. from the surface.——The Chilean mills, which broke down last week, have been repaired and the concentrating plant is again running night and day. On an average 125 tons of mill dirt is being treated daily.——Work will be in full swing at the Hall adit within two weeks. Arrangements are being made for the installation of a modern compressor plant, and the machinery will be ordered at an early date. It will also be necessary to put in 2500 ft. of new track. A number of Pittsburg capitalists have become interested in the company, and funds will be forthcoming for finishing all proposed work. B. J. O'Connell has been appointed manager.——Shipments have been made during the last week from the Sidney adit, East Argentine. Lessees at work on the blind vein which was cut 2125 ft. from the entrance, are breaking a heavy tonnage of high-grade ore. Carlson & Co. are working a body of ore that is from 18 in. to 3 ft. wide and average returns are received at the rate of $70 per ton in gold, silver, and lead. Killin & Co., leasing to the east, have an 8-in. streak of ore that is worth 2 oz. gold, 35 oz. silver, with small quantities of lead and iron.——The Almaden property is shipping high-grade ore that yields more than $90 per ton in silver and lead. These holdings have been undergoing development for the last two years, but it has only been during the last few weeks that large and rich pockets of mineral have been found. The mine was a heavy producer a number of years ago.——A 20-year lease on the John M. Osborne placer, near lower Fall river, has been granted by the Pittsburg Con. M. & M. Co. to the Dover & Brighton M. Co. The latter secures the use of all water-rights, with the exception of the water needed for the operation of the Brighton mines. It is understood that by the terms of the contract the Dover & Brighton Co. will increase the capacity of its mill from 50 tons to 300, and that all ores from the Brighton mines will be treated at a cost of $1.25 per ton. J. C. Sturdevant of Idaho Springs is general manager for both companies.——The Duncan group of claims, on Columbian Mtn., has been secured by the Golden Glory T. M. Co. The mine is at present developed by an adit level 250 ft. long, at the face of which a winze was sunk 70 ft. The property is equipped with engine, boiler, hoist, etc., and work has been started.——B. J. O'Connell, leasing on the Mendota below the Victoria adit level, is sending out an average of 100 tons of lead-zinc ore monthly. The product is being separated at the Mendota mill, which at the present time is running on custom ores.——The richest ore mined in many years in the Leavenworth Mtn. district is being extracted from the Ocean Wave level of the Colorado Central. Stoping is in progress upon a streak of mineral that measures from 18 in. to 3 ft. wide, and returns from 200 to 700 oz. silver per ton are being received. F. A. Maxwell is operating this property under bond and lease, and as the bond falls due July 1, 1908, an effort is being made to get out as heavy a production as possible.——A number of lessees are at work on the Kirtley, on Leavenworth Mtn. This property has remained practically in idleness for over twenty years, but as the vein runs parallel with the Colorado Central, and has produced some exceptionally high-grade ore, the outlook is favorable. McClusky & Co. are carrying a stope from the main level and have encountered a streak of quartz mixed with ore that is from 6 to 10 in. wide.——The workings of the Wide West have been placed in good condition and now cross-cutting will be started to get under the shoot from which a heavy production was made a few years ago. L. Baccheiri is operating under lease.——The Drummond group of five claims, four of which are patented, situated on Columbian Mtn., has been taken under bond and lease by the Golden Glory T. M. Co. The bond calls for $25,000, runs for five years, with royalty of 15% on smelting and 10% on concentrating ore, with all royalties applying on the purchase price. In the bottom of the winze, down 90 ft., there is exposed a 14-in. streak of silver-lead ore that mills $44 per ton. Operations were started this week.——A new strike has been made on the Sporting Times, Alpine Mtn. In extending the drift on the Moore vein a streak of solid smelting ore has been uncovered that is from 16 to 20 in. wide, and assays 1½ oz. gold, 15 oz. silver, and 55% lead.——L. B. Banks & Co. have taken a lease on the Coulter group of four claims, situated on Leavenworth Mtn. The adit, in 700 ft., is being advanced, and the Lone Tree vein will be reached within the next 50 ft.——The Homestake M. & M. Co., operating a group of claims on Lincoln Mtn., will resume work in a few days. This company is composed of a group of Georgetown business men, and no stock was ever placed upon the market. The adit, in 150 ft., is to be driven forward under contract, and the first vein will be reached within 20 ft.——E. E. Grubb has started work upon the Dewey property, Columbian Mtn. The adit is being driven ahead and a small streak of decomposed sulphide ore is exposed which assays 150 oz. silver per ton.——Work is to be resumed in a few days upon the Annie May group of claims, Columbian Mtn. The adit, now in 150 ft., is to be advanced. In the breast of the adit there is exposed a 6-in. streak of brown sulphide ore that mills as high as 300 oz. silver per ton. The vein runs parallel with the Stemwinder.——The Pelican mill will be started some time next week. The motors are now being connected and the mill-bins are filled. This plant has just been remodeled, the capacity having been increased from 125 tons to 250 per day. The aerial tramway running from the Seven-Thirty dumps, is practically completed.——In extending the Kalamazoo adit on the Snowdrift a streak of heavy lead ore was recently encountered on the hanging-wall. Some ore is being mined, but it is the intention of the management to continue driving ahead to reach the Snowdrift vein, which lies about 100 ft. distant.——Nels Williams has resumed work upon the Comet Extension, situated on Griffith Mtn. This property was formerly a good producer, but has been in idleness for a number of years.——It is understood that the Comet will soon pass over to the Capital M. & T. Co., a deal having been under way for several weeks. The Comet is an extension of the Aetna, which is yielding such large and rich bodies of high-grade ore at the present time.——The Old Missouri mine, on Seaton Mtn., has been taken under bond and lease by Jos. Boyd of Idaho Springs. The work of cleaning out the shaft and various levels will be started at once, and as soon as completed the shaft will be sunk 100 ft. deeper.——Work is to be resumed on the Kinda mine, on Bellevue Mtn. If the Lucania adit is driven ahead, the Kinda vein will be reached within 200 ft. It is reported that the owners of the Lucania now have the matter of resumption under consideration.——The raise being carried from the fifth to the fourth level on the Little Mattie mine has been completed and a free circulation of air obtained. The lessees are carrying a stope on a streak of ore that is from 10 to 20 in. wide and from which average mill runs of more than 80 oz. silver per ton are being received.

Georgetown, June 1.

LAKE COUNTY.

The machinery which was formerly used on the old Graham property has been moved to the Catawba, which is under lease to Alex. Harvey and associates.——The large extension to the trestle from the Yak tunnel has now been in use for several weeks, and the electric trains have been successfully running over it. There is sufficient space between the ends of the old and new trestles to take care of the waste that will be hauled from the mine for many years.——Iron shipments have been started from the Shamus O'Brien on Yankee hill, which is under lease to Andrew Clooney and asociates. The work on this property is being carried on near the surface.——John Shimmins, who is leasing on the Star of the West, on Iron hill, will start shipments this week. Mr. Shimmins has had a force of men at work on this property for several months, and just recently encountered a body of ore from which he will send about 25 tons per day to the smelters. The material contains iron, but also carries a percentage of lead.

SAN JUAN COUNTY.

Work on the excavation for the Kittimac mill, near Mid-

dleton, has been suspended temporarily, pending some alterations in the plans.——The California Mountain Mining Co. will start operations next week at its property two miles east of Animas Forks.——A rich strike is reported from the property of the Fleece Mining Co., in Picayune gulch.——The litigation between the Tom Moore and the Minnie Gulch Mining companies has been amicably settled. All the suits have been dismissed and the receiver has been discharged.

IDAHO.

LATAH COUNTY.

(Special Correspondence).—The Latah Copper Mining Co. has ordered a boiler, hoist, engine, and compressor, and will sink a winze below the present adit level.——All machinery for the reduction plant of the Mountain Gulch Gold Mining Co. is on the ground and ready to be set up. The ore is a friable quartz-gold.——Active work has commenced on the Sampson group, owned by Portland capitalists.——The Gold Nugget Co. has begun development on its group of claims adjoining the Mountain Gulch.——At the Mizpah the raise from No. 2 adit has been driven 90 ft. This will connect with the shaft, and as soon as the work is completed shipments will begin. A railway is promised by the Idaho, Washington & Montana Railway Co.——A shaft is being sunk on the West Mizpah Co.'s property. The ore of both properties consists of copper oxides in the upper workings.

Moscow, June 1.

IDAHO COUNTY.

(Special Correspondence).—Nine feet of lead ore is exposed in the bottom of the shaft being sunk on the vein in the Granite & Allie property, on Granite creek, near Burke. The shaft is down about 120 ft. and will be sunk to a depth of 200 ft. before driving is begun. Assays give returns of $67 per ton in lead, silver, and gold.——The Champion Copper is driving both ways on the foot-wall of the vein recently cross-cut. About 20 ft. of this work has been done and the ore in the face of the drift averages about 6% copper.——Development work on the famous Pilot mine at Murray is to resume June 1. A cross-cut adit which was started last fall will be continued 200 ft. toward the vein. The Pilot is the mine from which the richest gold ore ever found in this district was taken in the summer of 1906. Samples of this ore assayed as high as $30,000 per ton.——The new stamp-mill being put up at the Shamrock property, near Thompson, is rapidly nearing completion, and will be in operation within the next month. There is a large quantity of gold ore ready for the start.——Work has commenced on the driving of the 4122-ft. tunnel on the Copper King property, near Mullan. The tunnel will give a depth of more than 800 ft. below the lowest of the present workings, but it is estimated that, owing to the dip of the orebody, the vein will be encountered at a distance of about 3200 ft.——An accidental discovery at the property of the North Fork Mining Co. near Wardner shows that for some time past the men have been working in a black carbonate ore. A sample brought up to Wallace gave assays of $100 in copper, $90 gold, and 30 oz. silver per ton.

Wallace, June 1.

A carload of machinery for the Frisco Mines Co. has been shipped from Paterson, N. J. The car contains a boiler, engine, compressor, electric generator, several machine drills, a saw-mill, and complete accessories. An additional order has been placed for a 5 stamp mill.——The Idlewild group of claims, at the head of Campbell gulch, has been sold to J. D. Wooden, and work has been resumed.——W. H. Kirk has resumed work on his Saradoc group, on Blowout mountain.

SHOSHONE COUNTY.

(Special Correspondence).—The Hecla mine has resumed operations and about 150 men are now at work. The company will soon be shipping ore, and sinking on the deep-level shaft will also be continued.——The Rex, which closed down a short time ago, will resume work this week, under the management of P. J. Keane, and start sinking from the 300-ft. level to the 650. A force of 18 men will be employed. The level from which ore has recently been taken will be abandoned, and the mill will not start again until large reserves are developed.——The Charles Dickens mine, on Moon creek, will be running the newly completed concentrator in another fortnight. Reserves of ore have been opened for a continuous run.——J. L. Bailor of the Success Mining Co., which recently bought the Monitor mine, near the Montana line, states that the property will be worked this summer, beginning June 15. The Success is under bond to sink 300 ft. and to cross-cut 1500 ft. Work will be done on a winze from the 400 to the 700-ft. level.

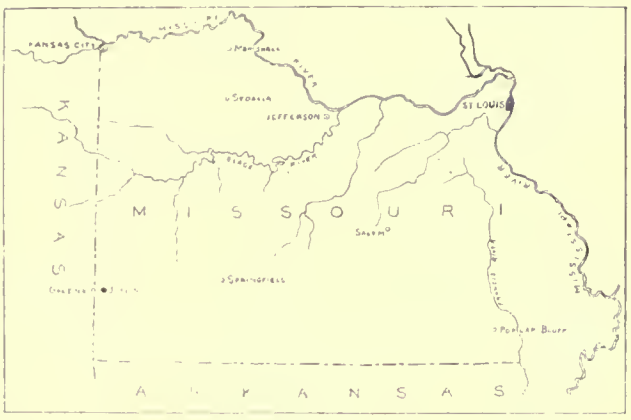
Wardner, June 2.

A. M. Strode has given an option on his interest in the Mineral Farm mining property, near Mullan, to a company of Missoula men. The consideration is not known, but is believed to be $25,000.——Copper glance has been struck in an adit on the Copper Age, adjoining the Monitor mine.——The North Bunker Hill Mining Co. will begin operation on its property next week. A cross-cut adit will be extended 50 ft. farther, where it is expected the orebody which was cut in the shaft will be struck.——A strike of shipping galena has been encountered on the property of the Cedar Creek Mining Co., on Cedar creek, two miles northeast of the Hercules.——A car of ore has been loaded at the Meadow Mountain property, near Saltese, and will be sent to the smelter at once. This is the first car of ore to be sent from the property.

KANSAS.

CHEROKEE COUNTY.

(Special Correspondence).—The Hartford Mining Co. has



Outline Map of Missouri.

completed its new concentrating plant but will not begin operations for some time. The new company is working in virgin territory south of Galena.——A strike has been made on the Charles Rains land, at Happy Hollow, southeast of Galena. A shaft has been sunk to the orebody but driving has been delayed until a pumping plant can be installed.——The rich strike made on the Windle Bros. lot on West Seventh street some time ago has caused many others to lease property in the vicinity and start prospect work. Shellack & McKinney have taken a lease across the street, and will sink a shaft to the same level as the Windle.——The Myrtle Mining Co., at Baxter Springs, has installed a Sullivan air-compressor, a 125-hp. boiler, and a sand-jig. An elevated tramway has also been built, and the plant will soon be running with two shifts.——A new company has taken over the Old Abe mine, and preparations are being made to construct a dam across Crawfish creek, to provide sufficient water to run the mill. The company last week sold 3100 lb. of lead ore.——A rich silicate strike was made near Peoria, on the W. W. Scott land. Four shafts are being sunk on the tract, and one shaft, with two men working, is getting out about two tons per day. A 9-ft. face of the ore has been opened at 35 ft.——A drill strike showing 18 ft. of rich zinc and lead was made on the Little Four lease, north of the shaft. The strike was made by William Earl, and is the fourth drill-hole into the orebody.——A new concentrating plant is being erected south of the Mission mine, on the Big Chief lease. One

shaft is into the ore and some driving has been done.——Iowa and Oklahoma capitalists have purchased the Kramer-Morse mine, at Baxter Springs. The new company has opened up one of the best deposits of ore found in the camp. Drilling has been thoroughly done, and it has proved that an orebody 48 ft. thick underlies a large portion of the lease of 40 acres.——The Good Luck Mining Co. has opened a large body of free zinc ore at the 100-ft. level. A large quantity has been piled on the dump and a concentrating plant will be erected.——The Eastman Land & Investment Co. has overhauled its mill, and has made a number of changes in the concentrating process, which are expected to obtain better results in saving of the fine.

Galena, May 26.

MISSOURI.

JASPER COUNTY.

(Special Correspondence).—During the past week there was a decrease in the price of zinc ore and an increase in the price of lead. Zinc brought only $38 per ton, as highest price on an assayed base of $35 per ton of 60% zinc. Lead brought as high as $59 per ton, which was an advance of $1 per ton over the top price of the preceding week. This increase in the price of lead is fortunate for many of the mines in this district, since most of them produce enough lead so that the added income offsets the decline in zinc. The largest producer in the Joplin camp was the Granby M. & S. Co., with 317,820 lb. zinc and 14,670 lb. lead. The total production for the Joplin camp was 1,837,920 lb. zinc and 214,500 lb. lead, with a total value of $37,465. The heaviest producer in the Webb City camp was the Bradford-Kansas City mine, with 541,490 lb. zinc and 58,430 lb. lead. The production for the Webb City camp totaled 2,437,020 lb. zinc and 749,920 lb. lead, with a total value of $63,176.——The Missouri Metals Co. is operating on the Condon land at Chitwood. A drift is being driven at 136 ft. to a drill-hole sunk to that depth which showed good ore. ——A company, composed of Burt Lyon, Leo Yount, A. J. Smith, and F. W. Kelsey, has been organized to develop a 20-acre lease on the Leonard land at Chitwood. Three shafts are already into ore. The new company will further develop the tract by drilling before commencing active operations. After thorough development a modern concentrating plant will be erected.——Several rich strikes have been noted recently in the Chitwood camp, both in new and old workings. Among the more important was the strike made in the Maude L., by Harry Gundling. The Maude L. was a former producer and the strike was made by sinking a winze 20 ft. in the old drift. The shaft has been sunk to an equal depth and the same kind of ore encountered. The Cumberland, an adjoining property, is also being developed by Mr. Gundling.——The new 150-ton mill at the Lounetta mine is now in operation. Drill holes on this land show a rich ore from 68 to 118 ft. Two shafts are down 110 ft. and are connected, but only one drift will be worked for the present.——J. K. Jacobs, of Baxter Springs, has purchased the mine owned by Weir & Co., northeast of Joplin, on Turkey creek. The mine has a shaft in ore at the 100-ft. level, but a great deal of pumping will be done before active operations can be begun. ——Development on the Spencer land in the old Midway camp northeast of Joplin has shown the existence of a large body of ore on the lease of the Kalitan Mining Co. The drill penetrated ore from 12 to 35 ft. thick. Four shafts have been sunk and hoisting machinery installed. ——The Moonshine Hill Mining Co., operating a 36-acre lease on East Seventh street, has struck ore at 85 ft. The orebody is 15 ft. thick. Four shafts are into ore and active operation has begun.——Plans are being perfected for the further development and re-opening of the old Center Creek Mining land, between Webb City and Carterville. This tract produced over $13,000,000, and recent investigation proves that there is still much ore in the upper levels and the lower workings have scarcely been touched. Among the companies operating on the tract is the Good Shepherd Co., which holds a lease on the western line. The company is re-opening some old shafts to reach some uncut ground. A 250-ton mill is being erected.——A rich body of ore has been opened up on the Tom & Jerry lease, northwest of the Good Shepherd. The ore was found at 185 ft. Two shafts have been connected by an incline tramway. A 250-ton mill has recently been completed and is now producing. The ore is of the sheet variety and contains from 3 to 5% zinc-blende, with a small amount of galena.——The Corrie Cole Mining Co. has just re-opened one of the old shafts on the Center Creek Mining Co.'s ground and ore is being taken from both the upper and lower levels. A concentrating plant has been purchased and moved to the property.——Bendelarie & Cook are opening up a sheet ground deposit north of Webb City. Zinc-blende has been found at 215 ft. Two shafts are in ore and driving has been under way for some time. Development has progressed far enough to furnish ore to supply a 250-ton plant which is in course of erection.——A new company has taken over the old Wampler land at Scotland, and is installing pumping machinery. The previous company abandoned the tract on account of high water soon after the completion of two shafts to the 120-ft. level. Galena was penetrated at the 60 and 80-ft. levels, and blende at 120 ft.——The Columbus Mining Co. has erected a tailing mill at Oronogo, on the Old Judge lease, and will treat the tailing from the Old Judge, which assays 3 to 4%, and upon the sludge sand, which contains from 9 to 12% blende.——Development work has been begun on the Wheeler land, at Carthage, just north of Spring River, by Hurley, Fellows & Eckman. A contract has been let for 1200 ft. of drilling. The Garlinger farm, still farther northwest, has been the scene of development work. Two holes penetrated ore at 212 ft. The company will sink nine more holes on the 40-acre lease.——The Davey Crockett Co. is sinking a shaft into a rich body of free ore just east of the Troupe-Mignonette mine. The Troupe Co., on an adjoining tract, is also sinking a shaft to strike a sheet of ore discovered by drilling. The Troupe Co. will soon erect a concentrating plant.——East of Carthage, the Lone Star Mining Co. is developing a 20-ft. face of 10% zinc-blende, found below a zinc silicate deposit. A 200-ton plant is being built.

Joplin, June 1.

MONTANA.

The St. Paul mine, 18 miles south of Libby, has started an adit at the creek level and expects to strike the vein within 40 ft.——The final payment has been made on the Silver Crown property, on Granite creek, 10 miles from Libby. The new owners will put in a compressor and air-drill and push development.——M. S. Lindholm has purchased the property of the Bear Creek Mining Co., on Libby creek, 16 miles from Libby, and is now at work repairing the flume and ditch. Development will be undertaken on a large scale and for that reason Mr. Lindholm does not expect to begin sluicing until next season.

NEVADA.

CHURCHILL COUNTY.

The Fairview Mizpah Co. is putting in a small gasoline engine and a blower to aid in the ventilation of their adit. ——It is reported that a 6-ft. orebody assaying $100 has been uncovered on the Almanto estate.——The new hoist on the Nevada Crown is working, and sinking is in progress on the shaft, which is about 100 ft. deep. The company is also driving an adit to strike the vein at the 250-ft. level.

ESMERALDA COUNTY.

The Round Mountain Mining Co. declared its first dividend last week. The total amount is $32,000, which is at the rate of 4%.——The Nevada Empress Gold Mines Co., which owns a group of claims in the Gold Mountain district, 35 miles south of Goldfield, has purchased a 100-ton mill and expects to have the plant in operation by August 1.——The Loftus Davis Co., which controls the Great Bend, is to sink a 500-ft. two-compartment shaft on that property.——The Victor, one of the properties of the new C. O. D. Consolidated, is the scene of a rich strike by the Victor Leasing Co. Nearly six feet of $50 to $60 ore is

exposed on the 250-ft. level. This strike is encouraging, in that it shows the main ore zone of Goldfield to extend farther southeast than had before been proved.——The work of enlarging and re-timbering the shaft of the Sprague lease, operated by the Puritan Mining Co., has been completed. Lateral work will now be started and two shifts employed.——The mines of Goldfield produced, during the week ending May 29, 1904 tons of ore, valued at $151,360.

HUMBOLDT COUNTY.

The El Rancho Mining Co., at Tip Top, has struck high-grade ore in an adit at a vertical depth of 200 ft., and is now driving another adit at a lower level to determine the extent of the orebody.——The Kindergarten mill and the Mazuma Hills have both started for the first time this week.

LINCOLN COUNTY.

The Nevada Horn Silver Mining Co., at Pioche, has placed an order for a 25-hp. gasoline hoist.——Clayton & Crittenden, who are leasing on the New Year's Gift, have received returns from the car of ore recently sent to the Needles smelter of a little over $43 net per ton.——The Bristol Con. Mining Co., at Pioche, has resumed, employing 15 men. The ore from this property will in future be hauled by wagon to Jack Rabbit, and from there to the freight depot, the Nevada-Utah Co. will handle it on their narrow-gauge system.——The Nevada Central has put on another shift.

LYON COUNTY.

A discovery of rich copper ore was made last week in the Mason Valley mine, at Yerington. A 6-ft. body of cuprite, associated with native copper in the form of fine threads, was uncovered in adit No. 3, at a vertical depth of 350 ft. At the time when the Comstock was in its glory the Mason Valley shipped large quantities of bluestone for the use of the mills along the Carson river.

NYE COUNTY.

The Tonopah-Liberty mine, 25 miles north of Tonopah, is enlarging its mill from 10 to 20 stamps, and is installing a 100-ton Huntington mill.——G. E. Holesworth reports a strike in the Breyfogle, at Manhattan, which he thinks is the Thanksgiving vein. No assays have been made yet, but it is believed to be rich ore.——The Georgia Bullfrog, six miles northeast of Beatty, has uncovered a 6-ft. orebody which assays $272 per ton.——The Security Reduction Co., recently organized to take over the holdings of the New Belmont Amalgamated Co., at Belmont, has placed orders for a 100-ton reduction plant and several mine-pumps.

WHITE PINE COUNTY.

It is reported that the old Egan mine, at Cherry Creek, is to be re-opened.——The Copper Bond Co. is prospecting its ground west of the Veteran mine with a 6-in. churn-drill. They claim to have struck ore containing 18% copper and $2 to $20 gold.——The Ely Bonanza management is unable to lower the water in the shaft and is planning for another method. It is believed the water contains 2% copper.——The Siegel mines, in the eastern part of the county, have been closed down temporarily on account of a reduction of the wage scale. The miners would not submit to a cut of 75c. per day, and hence operations have been suspended until a new force arrives.——The Hunter Con. Mining Co. has been incorporated to take over and develop the mining property a mile north of the Vulcan mine, at Hunter. The new company will at once sink a two-compartment shaft.

OREGON.

The Ashland mine, at Ashland, which has been closed for the last seven years, is to be opened again by a company of Los Angeles men. The mine is flooded below the 500-ft. level. New hoisting and pumping machinery will be installed and a mill erected near the main shaft. The Ashland was a great producer 12 years ago, and has, it is estimated, produced more than a million dollars in gold.——A wagon-road is under construction from the Vesuvius mill, in the Bohemia district, to some mines owned by F. J. Hard. After its completion ores from these mines will be treated at the Vesuvius mill.——A complete water-power electric plant has been shipped to the property of the Washongal Gold & Copper Mining Co., on upper Washongal river. A complete smelting and reduction plant is under construction for the treatment of some high-grade copper ore which the company has blocked out in its mine.——The Greenly Development Co. of New York has purchased a large block of the stock of the Imperial mine, at Cable Cove, and also secured options on all the stock owned by the Detroit syndicate except that of A. H. Sibley. The new company will at once begin development and will drive another adit 300 ft. lower than the Miner. A small force of men is already at work in the drift known as the intermediate level.——It is again rumored that a merger of the Ibex and the Bald Mountain properties has been effected. The Ibex has been proved to be a property of merit, and while the Bald Mountain management has not made public what it really has, it is known that it can be most advantageously worked

Utah.

through the Ibex. The 50-ton mill on the latter is one of the most complete in the district, and would be a profitable adjunct to the Ibex.

UTAH.

BEAVER COUNTY.

The Cupric Mines Co. has been incorporated to work the old Washington property, adjoining the Horn Silver and the Imperial Copper. The new company will not utilize the two inclined shafts now on the property, but have started a new shaft close to the Newhouse or Cactus mine adit.——An air-compressor is now in use at the Hub mine, at Milford, and development is progressing rapidly.

JUAB COUNTY.

The Opex mine, at Mammoth, was closed down last Saturday. The shut-down is only temporary and the development of the mine will probably be taken up again within a week or two. In the meantime some repairs are being made to the boilers.——The shipments from the mines of Tintic for the week ending May 29 were as follows: Centennial-Eureka, 40 carloads; May Day, 4; Eureka Hill, 7; Yankee Con., 2; G. A. Franke (Utah lease), 1; total, 54 carloads.——Work is progressing rapidly in cleaning out the caved portion of the drift between No. 2 and 3 shafts on the 1500-ft. level of the Ontario, at Park City, and it will be only a short time until the draining of the mine is complete and work resumed in the ground that has been flooded for so long.

Special Correspondence.

LONDON.

Montana Mining Co. v. St. Louis Mining & Milling Co.—San Francisco del Oro.—British Broken Hill.—Great Fingall.

Whatever advantage may be urged in favor of the United States apex law, a good many English mining companies have from their experience gained some knowledge of its harassing nature. Perhaps none has suffered so much in this way as the Montana Mining Co., which owns the once famous Drumlummon mine. This company has been the victim of the litigious spirit of its neighbor, the St. Louis Mining & Milling Co., for 15 years, and the dispute is as well known and as insufferably drawn out as Jarndyce *v.* Jarndyce. In the series of actions brought against it, the Montana company has been exceptionally unsuccessful in the lower courts and has won only in the Supreme Court of the United States. Last autumn an action brought by the St. Louis company over the 'Compromise' ground was settled in the Montana company's favor, but the St. Louis company has since applied for leave to amend its pleadings. It has admitted that it has no right to the Compromise ground, but now alleges a claim to the ground known as the Nine Hour Workings, and to one million dollars as the value of the ore taken out since 1893. An injunction has been granted preventing the Montana company from conducting further operations pending a trial. As a matter of fact, the Drumlummon mine is now quite worked out, the old tailing heaps exhausted, and the company intended to shut down entirely this year. The new law-suit will prevent doing this. Though the mine is worked out, the company is considered fair game, for it has £37,000 reserve fund and £33,000 of uncalled capital, besides owning another property at Edgemont, Nevada. I suppose that as long as the Montana company has any resources it will suffer from the persecution of its neighbor. Theoretically the apex law may be perfection, but a good many of us would be quite willing to class the dipping of a vein out of our boundary as one of the risks of mining, along with pinching out in depth, impoverishment of ore-shoots, and similar slices of ill-luck.

In your issue of April 18 one of your correspondents draws attention to a report upon a property, in which the value of the ore is given as the sum of the values of the metallic constituents, quite ignoring the metallurgical question of their extractability. An example of this method of valuing mines was seen in the flotation in London five years ago of the San Francisco del Oro mine near Parral, Chihuahua. The ore deposit contained lead and zinc with a good deal of silver, and some gold and copper. In giving the value of the ore the directors took the average of the assays and added up the metallic constituents. It is hardly matter for wonder that the company has made no profit, and that it now contemplates the raising of further capital, in spite of the fact that the mine has ready for stoping over 300,000 tons, containing 26 oz. silver per ton, 12% lead, and 23% zinc. Shortly after the flotation of the company, some of the shareholders saw the fallacy of the directors' reasoning and declined to pay up all of the calls, preferring to forfeit the £10,000 they had already paid. To show how the directors still cling to the total-value theory, it is only necessary to mention that one of them at a recent meeting of shareholders referred to the gross-metal value of the ore as £8 10s. 0d. per ton at the present low prices of metals, and comparing it to a similarly big gold mine with 2-oz. ore. The policy of the San Francisco del Oro mine has been to ship the most saleable parts of the ore to the smelter, in which way expenses have been met most of the time. The company has always been short of working capital and has therefore been unable to erect concentrators or other plant for the treatment of the ore. At the present time the directors are experimenting with the Sutton-Steele dry concentrators, but their critics are recommending them to try water concentration, on the system adopted at the neighboring Tecolotes mine, where similar ore is found. It is to be hoped that they will be able to raise the necessary money to provide a dressing plant, and to fix upon a suitable process, before all the best ore is picked out. At the present time the shipping-ore is being sorted with particular care, owing to the low price of metals, and much richer ore is now being shipped than was the case a year ago. The rate of shipment is 2000 tons per month. During 1907, the shipments amounted to 7294 tons, which realized £187,736. For a long time, during the last two years, shipments ceased.

The question as to the advisability of closing down a mine partly or totally during periods of low prices of metals is one of the most difficult that is met with by directors and engineers. Some are content to go slow and not hurry their plant, others sort their ores so as to still make a profit, while others take the bold step of closing down altogether, with the intention of not starting again until prices have recovered. It takes a good deal of courage to decide on the last named course, and it is not often that a company with plenty of funds in hand will adopt the plan. It is noteworthy therefore to mention the case of the British Broken Hill mine in New South Wales, which has decided, for the second time in its life, to shut down the mill. The first time was in July 1901, when the mill remained idle until March 1903. In those days lead and silver were very low. When lead recovered to £12, the British Broken Hill was able to resume and work at a profit. A similar crisis occurred at the end of 1907, and the directors decided once more to shut down the mill. It happens that lead is now £13, and the enquiry may be legitimately made as to why operations cannot be conducted while this price rules, although it was worth while re-starting in 1903 with lead at £12. There are several reasons for this. In the first place, the labor association of Australia has fixed wages at a higher rate; secondly, mining operations are conducted at a greater depth and at a farther distance from the mill; and thirdly, the smelters do not now give such good terms, having raised their returning charges recently. The company on December 31 last had a balance in hand of £46,700 and a reserve fund of £10,000. During the stoppage of the mill some development work will be done and the reorganization of the plant completed. Since work re-commenced in 1903, dividends totaling £210,000 have been distributed, and £75,000 spent out of revenue in renewals and additions. During the second half of last year, 68,268 tons of sulphide ore and 929 tons of carbonate ore were raised. The concentrating plant dealt with 69,417 tons assaying 13.9% lead, 14.7% zinc, and 9 oz. silver per ton. The yield was 10,462 tons, assaying 61.7% lead, 8.9% zinc, and 26.8 oz. silver, all of which was shipped to Europe. The recovery was 66.8% of the lead and 44.7% of the silver. The zinc tailing amounting to 48,697 tons, and 10,258 tons of slime was placed on the dump, to be treated hereafter by the Zinc Corporation.

At the Great Fingall mine in West Australia no new discovery has been made during the past year, so that the prediction made by the managers, Bewick, Moreing & Co., a year ago, will probably come true, and the mine may not be expected to last much over a year. Below level 13 there is a large amount of low-grade ore, of which it is difficult to gain a sufficiently exact estimate by sampling to enable the engineers to say whether it will pay or not. During the year 1907, the ore treated in the 100-stamp mill amounted to 261,057 short tons, giving a total yield of 99,215 oz., of which 56,413 oz. was won by amalgamation, 17,580 oz. from concentrate, and the remainder by cyaniding the tailing. The proceeds from the sale of gold were £423,193, and the profit was £174,473. After paying taxes and allowing for depreciation, the net profit was £137,558, out of which £137,500 was distributed as dividend. The adjoining mine, the Kinsella, which in the early Australian days proved unprofitable, has been acquired, primarily with a view to obtaining a water supply. It is intended to pump the mine dry and sample it. It is quite possible that with modern plant and methods of treatment the old mine may now be turned to profit.

MEXICO.

Guanajuato. — New Plant. — Increased Production.—Railroad Facilities. — Zacatecas. — Magistral Smelter. — Guerrero Mill, Pachuca.

Notwithstanding the continued low price of silver, the production of the great old silver camp of Guanajuato seems to have been in no way curtailed, but rather it would appear that production has been increased so that the value of the returns remain somewhere near unchanged. Encouraged by the way in which the Mexican Milling & Transportation Co. has been pushing the work on its Mineral Belt railroad, the entire camp has shown enthusiasm. Some time ago a rich strike of a 4-ft. vein was made in the El Monte de San Nicolas, and another of high-grade ore on the 700-ft. level of the Sirena mine of the Guanajuato Consolidated Mining Co., both of which are adding to the returns of these companies. The Cata and Tepeyac of the Guanajuato Reduction & Mines Co. are also getting into good bodies of ore, and better returns can be looked for in the future from this company. Up to the present time the larger part of the tonnage treated by it has come from the old dumps. The Pinguico and Peregrina, as well as other smaller properties, continue to add their regular quota, and *buscones* are at work all over the camp, so that now the production is well over ₱1,000,000 per month, at a cost of perhaps not more than ₱400,000. The big La Luz properties of Messrs. Bryant and Mellhiney have been floated, and include, in addition to the La Luz group, the Bolañitos and Refugio of the La Luz district, under an organization with $5,000,000 capital, and a 1000-ton reduction plant is being planned by the company. Mr. Geo. W. Bryant has just gone to New York in the interests of this and other Guanajuato properties with which he is connected. The Lewisohns are said to have taken an interest in the San Cayetano, which was bought some time ago from the Mexican Mines Association of London. Chicago capital has become interested with Dwight Furness in the Cabrastante, beyond the Nayal; an electric pump has been put in, the old winze has been unwatered, and an additional 25 metres has been sunk, from which a very good grade of ore is being taken. This gives a material extension to the productive area of the Guanajuato district. El Cubo, another of the outlying properties, which has been a producer for many years, is being thoroughly gone over and rehabilitated. The greater part of this work has been made possible by the introduction of electricity by the Guanajuato Electric Light & Power Co. Additions now being made will give it a distributing power of 20,000 hp. (of which 60% will be used for mining purposes), as against the 4000 hp. brought in five years ago, at which time it was believed the provision made would greatly exceed the demand.

Guanajuato's old records, showing approximately ₱1,000,000,000 of silver produced in the past three and a half centuries, has always seemed like one of the marvels of the mining world, and not a few were skeptical as to their accuracy. But the performances of the present day lend color to the truth of the ancient records, for it is said that now, with something over 600 stamps dropping in Guanajuato, and over 2000 tons being cyanided per day, the camp is producing at a rate three times greater than the old record-rate. This increase in production is due to the new and better methods of mining and treatment, which make possible the handling of the lower-grade ores which formerly could not be touched. Where the old methods entailed an expenditure of from ₱15 to ₱30 for mining and another ₱13 to ₱40 for reduction, with a low extraction, mining and milling today is being done for ₱10 per ton and an extraction of 90% is being obtained. Furthermore, in the old days only the Mother Lode was worked, whereas today all parallel and cross veins are being worked, and from these latter come the gold, which did not attract the old-time miner because of the difficulties of extraction. The completion of the Mineral Belt, connecting all the principal mines and vein-systems with the custom mills, and the entrance of the Mexican Central railroad into Guanajuato proper, is going to give such encouragement to new properties as to cause an even greater production in the coming year.

Incidentally it is pleasant to chronicle the fact that the three Mexicans who so brutally murdered George Rose, the superintendent of the Pinguico mill, in his home in Guanajuato on the night of September 11 of last year, have been sentenced to be shot, and it is not believed that their lawyers will take the trouble to appeal.

The mining conditions in and about Zacatecas are rapidly improving, and it is believed that an additional impetus will be given to the district on the completion of the smelter now being erected by D. H. Norris of the Magistral mine. Though this plant is being built primarily for the Magistral, it will do a custom business as well, and operators will be afforded an opportunity to dispose of their ores to better advantage. The work is in charge of C. A. Haberlein, formerly assistant superintendent for the Torreon Metallurgical Co., at Torreon, Coahuila. The initial plant will only have a capacity of 50 tons, but it will be enlarged to meet increasing demands. The ores of the Magistral run from 8 to 10 oz. silver and 5 to 10% copper. The property is owned by Dudley H. Norris and Charles Gilbert.

Zacatecas, a mining town with a fame once world wide, has during the last twenty years gone from bad to worse,

A Corner of Guanajuato, Mexico.

and the population has dwindled from 80,000 to 30,000 or less. This was in part due to the long drought, from 1888 to 1893, which made the cost of living extremely high. More directly it was due to the mine workings getting down to and below the water-level, thereby adding to the cost of production, at the very time when the great drop in the price of silver took place, in 1893. This necessitated the closing of many properties. Among the few which continued operations was the El Bote, which for the past sixty years has been in bonanza. Last year it was purchased by an English company, and the old amalgamation mill was changed into a cyanide plant with a daily capacity of 250 tons. Encouraged by the results of El Bote, the work of unwatering had been started by the owners of the San Rafael, La Capilla, and the Mala Noche, and new work was undertaken at the Zaragoza and San Roberto, in both of which copper was discovered. Work was also begun on the Veta Grande and the Tajo de Panico, but the low price of copper and silver stopped the greater part of this, and another year will be required to regain the ground lost. Many good properties are in this condition, waiting for money to develop them, among which may be named the San Martin, within the City of Zacatecas, on the northeast side of the Cerro de San Martin, which was closed in 1892 because of trouble from zinc in the ore. Recent experiments with the ore on the old dumps, of which there is about 30,000 tons assaying 10 oz. silver, have shown that it can be successfully treated with cyanide. A company with a capital of $250,000 has been organized to operate this property. A 100-ton water-jacket furnace has been ordered for the Boca del Cobre plant, in the Nieves district. With this property has been incorporated the mines known as

San Nicolas, San Francisco, Santa Rita, and El Rosario, all in a fairly advanced stage of development.

The State of Zacatecas is giving encouragement to work that may be of assistance to the mining districts by granting a concession to Gustav R. Madero for a railroad to run from the station of Camacho, on the Mexican Central, east through the Pica de Teyra district to Mazapil and Concepcion del Oro, where it will make connections with the Coahuila & Zacatecas railroad of the Mazapil Copper Co., running to Saltillo. To another proposed railroad line, having as its object the making of connections between the principal mining camps of the State, there has been granted a subsidy of ₱2000 per kilometre of road built, together with the necessary lands from the State Government. Notwithstanding the bright future which some predict for Zacatecas, the camp which, next to Guanajuato, is making the most rapid strides toward rejuvenation and advancement is Pachuca, in the State of Hidalgo. We have already called attention to the changing of the Hacienda de San Francisco, and several other old patio plants, to the cyanide process, and now we are able to chronicle the completion and placing in operation of the 40-stamp Guerrero mill of the Real del Monte Mining Co., a sub-company of the United States M., S. & R. Co. This is the finishing touch of two years' development and improvement by this corporation. For some time past the Loreto mill, belonging to this company, has been cyaniding the low-grade ores of Real del Monte, and together with the direct shipments to the Aguascalientes smelter the receipts of the Real del Monte Co. has enabled it to declare its first dividend. It is perhaps the largest silver property in Mexico.

BENGUET, P. I.

Transportation Facilities.—Mines on Bued River.—Murphy and Copper King.

Baguio, the capital and central supply point for all the mines of Benguet province, is now within 11 hours of Manila. This has been accomplished by the recent completion of the railroad to Camp One and the establishment of an automobile line by the Government to carry passengers the remaining 20 miles. The two machines just purchased and put into service by the Government make the trip down this tortuous cork-screw road in 70 minutes. There is a drop of 4000 ft., with a maximum grade of 12%. This road, built some years ago to develop the mining interests, cost the Government over two million dollars, and now the skeptics are beginning to realize that the criticized officials were justified in building it.

The clean-up from the Murphy group, six miles south of Baguio on the Bued river, was late going in, due to lack of facilities for retorting. It amounted to 15 oz., valued at a little over $15 per ounce. The plant, which can hardly be called a mill, consists of a puddling box with screens, from which the pulp flows over an amalgam plate 18 in. wide by 8 ft. long. The lumber for this was whip-sawed on the ground. The whole hillside is being quarried and carried by Igorrotes on their backs to the box, where they rub it through the screens with their hands, throwing out the coarse stuff. In this way nearly a ton per day is treated, which furnishes a profit to pay for the mine development work, as only one white man is required. There are eight claims in this group.

The Copper King Mining Co., owning a three-stamp mill, adjoins the Murphy on the north. The vein system here has been opened for more than 2000 ft. from the mill-tunnel, and 1000 ft. lower.

Up the hill from the Copper King, H. P. Whitmarsh has the East Extension of this vein on his Philip claim. There is also on this claim another vein averaging 9 to 14 ft. in width and assays $10. This ore contains no copper, but much manganese and calcite. It is opened up by 120 ft. of adit and cross-cuts.

Across the mountain from the Philip, the Copper King vein is again found on the Ascencion group, owned by Calvin Hoar and others. This group consists of 10 claims, on which there are two main veins opened up by 976 ft. of adits and cross-cuts, scattered over the different claims. These workings show the veins to cross four claims. The Copper King lode, still dipping toward the north, shows its characteristic chalcopyrite ore in quartz, while the other vein is associated with manganese and quartz stringers, dipping 70° toward the south. On the Igorrot claim a 70-ft. adit cuts the south lode, which is then driven on for over 160 ft., where it averages 3 ft. wide, with 400 ft. of 'backs.' On the other side of a main ridge a 150-ft. adit cuts this lode, which is then driven on for 140 ft. toward the other workings, which are at a level 60 ft. lower. When the necessary raises are completed there will then be blocked out enough ore to warrant a mill. This ground requires very little timbering. On the Ascencion claim 190 ft. of driving shows the other lode to average 3 ft. of ore. It is also opened by small surface cuts and by an adit lower down on the other side of the mountain, on the Ascencion Annex claim, where it averages 4 ft. wide. On the Emerald claim this lode is opened by a 96-ft. adit. Work is progressing rapidly, and a mill will soon be provided if the present development discloses the ore now indicated. A superintendent's house and quarters for the laborers have lately been erected.

JOHANNESBURG, TRANSVAAL.

Labor Problems.—York Mine.—Condition of New Unified and Nigel.

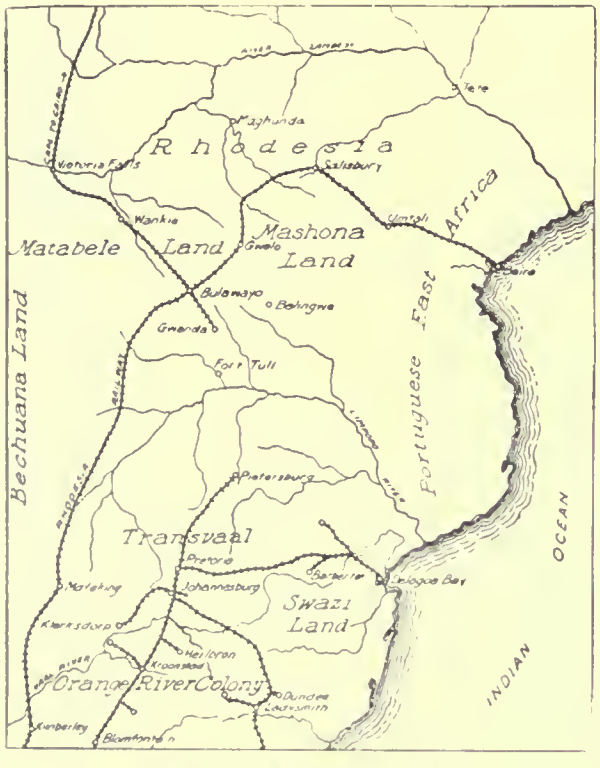
The problem of white labor on the Rand is the topic that is receiving the most attention at the present time. Although there have been some disappointments, the Government seems determined to solve the problem of the unemployed by finding work for the whites in the mines or municipalities. One of the leading daily papers is championing the cause of white labor, and in almost every edition gives the latest information concerning the white men who are doing rough laboring work in several of the mines. The experiment being tried at the Consolidated Main Reef mine is being watched with interest. Here they are replacing the Kaffirs by white men in the handling of the tailing. The white men take the work on contract at 4½d. per ton, and it is hoped they can earn between 5 and 6s. per day. So far the reports from the mine are not very favorable, but people still hope that the experiment will be a success. If found to be as cheap to employ whites in handling the residues from the cyanide works as to use Kaffirs, and if all the mines agree to do this class of work with white men, then the problem of the unemployed will be easily solved.

Another interesting experiment is being tried on the Ferreirra Deep mine. The Gordon drill people have taken a contract to break rock with their small machines, on the understanding that only white men be employed. It is thought that the higher intelligence of the white man will enable him to do this work cheaper with this machine than with Kaffirs. The terms given to the white men are such that an intelligent energetic man will be able to earn from 10 to 13s. per shift. The experiment has not been running long enough to know whether it will be a success or not.

On the York mine, in Krugersdorp, the departure made by Abe Bailey is turning out well. Instead of employing Kaffirs at the sorting tables, as is universal on the Rand, youngsters from 12 years and upward are put on to pick out the waste rock. They are earning from £3 to £4 per month, and this money is a great help to the indigent Dutch families to which they belong. The policy on the York seems to be to employ a white youth in preference to a Kaffir wherever it is economically possible to do so. The white sorters are working just as cheaply as the Kaffirs, and are doing better work. It is to be hoped that the other mines will follow the example set at the York mine, and employ white youngsters in the sorting department. One of the problems of the Rand is to find employment for the white youths who are growing up in our midst. The sorting houses will be a good school for them, where they will learn lessons of industry, and when they grow older they may go into the mine. A great obstacle to the success of the white labor is the opposition of the skilled artisan. Naturally the doctrine of the '£1 per shift' is jealously

guarded. They are against any scheme that tends to bring down wages. They readily see that if a large number of whites are taken on at a low wage, these workers will be only too pleased later on to do the skilled work for one-half the pay.

The ups and downs of mining, even on the Rand, are well illustrated by the history of the past two years of the New Unified mine. Some time back this mine was run at a loss, and the shares stood at 3 to 4s. each. A combination of good management and richer ore has brought the mine up steadily, so that today a profit of £3000 per month is being earned. Dividends are now in sight. The shares have risen with the profits, and in spite of the depression they now stand at 18s. each. The Nigel mine, in the Heidelburg district, has been doing so well lately that people are looking forward to increased activity for the whole district. So far this is the only successful mine in this part of the



Map of the African Goldfields.

country. It appears to be an oasis in an otherwise goldless desert. Much money has been spent in the Nigel district in developing payable mines. Now that the Nigel is doing so well, many feel inclined to try their luck again. For about the first time in the history of the Rand there is an abundance of Kaffir labor. So plentiful is the supply just now that the mines are refusing to take Kaffirs on unless they sign contracts for twelve months. This is a great advantage, for heretofore, when the Kaffir had everything his own way, he would not work longer than six months at a time.

DENVER, COLORADO.

Grazing Regulations. — Clear Creek. — Faker Sentenced. — Cripple Creek. — Conviction for Ore-Stealing.

The grazing regulations made by the Secretary of Agriculture have been upheld by the United States District Court at Denver in several recent decisions. Stock men whose cattle graze on the Government forest reserves must pay fees to the Government. The first decision established the validity of the regulations in the State of Colorado. Similar cases have been tried and won by the Government in Montana, South Dakota, Idaho, California, and Arizona. The stockmen raised the contention that the Government was no more than a private land-owner in the matter of State fence laws. The fence law of Colorado makes it impossible for persons to collect fees or damages from owners whose stock stray upon unfenced land. That the national forest reserves, although unfenced, are not subject to State laws is now well established.

The tunnel propositions in the Clear Creek district are unusually active. The Hall tunnel, which was started several years ago for the purpose of draining the Colorado Central mine at Georgetown, has been taken under bond and lease by local parties. The Burleigh Mining & Leasing Co., of Silver Plume, is constructing an aerial tramway from the Seven-Thirty dump to the Pelican mill, which has been remodeled and has had its capacity increased to 250 tons per 24 hours. The mill is also connected by tramway with the Pelican dump. The Pendleton Gomer M. & M. Co. has been organized by Idaho Springs parties to operate the mines known by the company's name in Russel gulch. At Central City the Jumbo M. & M. Co. has temporarily suspended operations, owing to the excessive quantity of water encountered at this time of the year.

Another faker has been caught and convicted by the postal authorities, namely, J. J. O'Hara, who advertised and sold the stock of the Goldfield Independence Mining Co., in October, 1906, and succeeded in swindling several eastern investors. He has been living in Denver of late, transacting business under the name of the Modern Investment & Securities Co. O'Hara was sentenced to one day's imprisonment, $500 fine, and the costs of the case, which will amount to about $12,000.

The Cripple Creek deep drainage tunnel was advanced 262 ft. during April, which was 40 ft. less than the record for March. The tunnel is in very hard ground, and recently considerable water has been encountered. The intermediate shaft is down 240 ft. It was sunk 99 ft. during April. At the deferred annual meeting of the stockholders of the Dante Gold Mining Co. in Colorado Springs, the former management was re-elected, and the best of feeling prevailed. The president of the El Paso Con. Gold Mining Co. has announced that all El Paso territory will be leased, despite the protest of J. F. Burns. Over 100 applications have been made for the few remaining blocks of ground. W. C. McKelvy has secured a two years' lease on the Black Jack claim on Rosebud hill. Another mining company to operate in Cripple Creek has been formed at Colorado Springs. It is known as the Block Mining & Leasing Co., and is capitalized at $50,000. Charles Anderson, who was the first man convicted under the law making ore-stealing grand larceny, is making determined efforts, through his attorney, to escape the penitentiary. Under the latest ruling he must go to jail while the constitutionality of the law is being determined.

During the month of April Leadville produced 64,000 tons of ore, which was less than the same month of the preceding year, but a slight increase over the month of March. Operations on the Garibaldi have again been resumed. This property was closed down in 1885 and has so remained until the present company took over the mine with a view to developing it through the old adit in California gulch. When formerly worked, the property is reported to have paid handsomely, but owing to failure to obtain right-of-way through certain grounds not owned by the former operators, the enterprise was finally abandoned. The new company will drive the adit to the Sunday vein, which they hope to reach after driving 1000 ft. farther, and will then reach a depth of about 800 ft. It is then proposed to raise to the bottom of the Sunday shaft, which now has a depth of 500 ft. The new organization is called the Ball Mountain Tunnel & Mining Co., and is composed principally of local mining men, among whom are M. A. Nicholson, Percy Hannu, L. A. Reynolds, Geo. E. Keeler, and W. Marrell. After remaining comparatively inactive during the winter, there is now much work in progress on Fryer hill. Among the old properties the Forepaugh, Robert E. Lee, and the Rupp have resumed. Also the Chrysolite mine, controlled by J. S. Shepherd and associates, has resumed and regular shipments are being made. On the Louise property in South Evans gulch, the shaft is being sunk, and at a depth of 400 ft. levels will be driven. The rich ore struck on the Catawba claim, on Canterbury hill, grows wider as the shaft is deepened.

SALT LAKE, UTAH.

Silver King Coalition. — Prince Consolidated, Pioche. — Park City Mines Merger. — Consolidated Mercur. — Bingham Production. — Ohio Copper.

At the annual shareholders' meeting of the Silver King Coalition Mines Co., operating at Park City, the retiring board of directors was elected, which organized with the same officers. The treasury contains about $200,000. Since last autumn production has been upon a reduced scale, but preparations are under way to increase the output. A suit will be filed in the Federal Court in a few days against the Silver King Coalition Mines Co., the Silver King Consolidated Mining Co. being the plaintiff. The defendant will be charged with having trespassed within the domains of the plaintiff, extracting therefrom a large tonnage of ore. Efforts to effect a compromise have so far been without avail.

Ore shipments from Park City last week were 190 tons from the Daly Judge, and 567 tons from the Silver King Coalition mine.

Talk of a merger between the Ontario, Daly, and Daly West, at Ontario, and the Naildriver, at Park City, has been revived, and negotiations are said to be actually pending in New York. This combination was planned about the time of the Ontario drain-adit disaster, about three years ago, which delayed the carrying out of the plans until now.

The annual meeting of the Consolidated Mercur Gold Mines Co., has been called for July 6 at Jersey City, N. J. The management gives out the information that dividends will be resumed before the end of the present year; that physical conditions are better at the mine now than they have been for several years, and that addition to the surplus is being steadily made. A shipment of $64,480 worth of gold bullion was made to the U. S. Mint at Denver last week, representing all but about $2500 of the April production.

Ore shipments from Bingham are heavier now than at any time in the history of that camp. Aside from the big copper producers, several of the smaller mines have resumed operation after several months' shut-down. The Utah Copper Co. is moving 100 carloads per day to its concentrating mills at Garfield and Copperton; the Boston Consolidated, 25 carloads to its concentrator at Garfield and 5 cars to the smelter direct; while the Utah Consolidated continues to keep up the average of 16 cars, or 800 tons, per day. The daily output of the Bingham district is now between 10,000 and 12,000 tons.

Salt Lake mining machinery dealers have been sending much mining equipment to Pioche, Nevada, lately, which camp seems to be prospering. Conditions have materially improved in the camp of Alta lately. The Columbus Consolidated has resumed operation of its mill, and is about to inaugurate regular ore shipments again; the Consolidated Flagstaff property has been taken over by the Flagstaff Copper Co., and development work will be started shortly; the control of the old Emma mine has passed to Jesse Knight of Provo, who will direct its development; and the South Columbus company is still conducting development and will begin ore shipments in the near future.

BUTTE, MONTANA.

May Output. — North Butte Contract. — Summit Mountain. — Trenton Co. — Butte & London. — Corbin Consolidated. — Continental.

The Continental mining district, a few miles east and south of Butte, is again receiving attention, and the belief expressed by Government geologists that the district contains the mother lodes of the big veins of the Butte district will be tested. Michigan and Montana men have organized the Lion Gulch Development Co., which has taken over the property of the Gold Flint Mining Co., situated eight miles southeast of the city of Butte and three miles north of Homestake, on the Northern Pacific railway. The new company will sink a shaft 1500 ft. deep. New machinery will be installed and men are at work building a road to the Northern Pacific track and erecting houses and cabins.

The old Ruby gold mine, 18 miles northeast of Butte, formerly owned by W. A. Clark and others, is again a good producer. Patrick Dowling, a Butte miner, took an option on the mine a year ago for $75,000, and almost immediately he opened up a good body of ore, from which he has paid for the mine, added new machinery, and is now re-building an old mill. He is also erecting an up-to-date cyanide plant with which to treat the tailing. As much as $12,000 has been received by Mr. Dowling from a single carload of the ore. The ore-shoot is about 150 ft. long and from 10 in. to 3 ft. wide. Several thousand tons of low-grade ore on the dump will average $10 to $20 per ton.

In May the mines of the Butte district produced about 27,537,300 lb. of copper from 346,425 tons of ore. The mines have probably now reached their high mark of production. The various companies contributed to the May total as follows:

Companies.	Tons ore.	Pounds copper.
Boston & Montana	105,400	8,432,000
Anaconda	110,050	8,253,750
Butte & Boston	10,850	759,500
Washoe	10,075	705,250
Parrot	10,850	737,800
Trenton	6,200	403,000
North Butte	40,300	4,030,000
Butte Coalition	31,000	2,480,000
Original	15,500	1,240,000
Miscellaneous	6,200	496,000
Total	346,425	27,537,300

The new smelting contract between the Anaconda Copper Mining Co., operating the Washoe smelter, and the North Butte Mining Co., became effective June 1. Under it the North Butte gets a concession of 50c. per ton, an approximate saving of $700 per day. It is understood that the Butte Coalition Co. has a similar contract with the smelter.

The North Butte Co. is cross-cutting to the veins from the 2000 and 2200-ft. levels of the Speculator shaft. The lowest depth at which mining is being done at present is on the 1800-ft. level, where both the Jessie and Edith May veins have been opened. Driving on that level is progressing, and the veins are found to continue extremely rich. The North Butte, like other companies in the Butte district, recovers much silver and gold from the copper ores, enough to pay about half, or more, of the entire cost of labor and supplies. The North Butte, for instance, gets about $60,000 a month in silver and $4500 in gold.

A number of mining men, engineers, and geologists have visited the new copper discoveries in the Summit Mountain district, near Buxton, about 10 miles southwest of Butte. The country has not yet been sufficiently developed to demonstrate any great depth to the orebodies, the deepest workings being only 130 ft. The properties are situated in typical Butte granite country. There is a mineralized zone about half a mile wide through this granite, having one eruptive dike of porphyritic rhyolite or quartz porphyry, which has been explored for a distance of 6000 ft. Three or four veins have been explored.

The Trenton Mining & Development Co., one of the Amalgamated subsidiaries, has made an annual financial statement showing a paid up capital of $1,000,000 and assets amounting to $1,800,000, with an indebtedness of $55,500. The Trenton operates only the Gagnon mine, a low-grade copper property, but having high silver and gold content. The Butte & London Copper Development Co. in its annual statement shows a paid up capital of $5,000,000, and assets, including cash and stock in the treasury, of $5,439,527. The company was recently forced to suspend work for lack of sufficient funds.

The Corbin Consolidated Mining Co. has been organized and incorporated for the purpose of operating in the Corbin district. The new company is capitalized for $500,000, divided into 100,000 shares at $5 par. The directors are J. L. Meixell, S. L. Case, D. M. Armstead, H. K. Welch, and M. B. Jenkins.

Discussion.

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy.

Dredging in New Zealand.

The Editor:

Sir—In a late issue of your valuable paper I saw a brief article on gold dredging at Waipori, New Zealand.

The dredge is stated to have cost £3500, or about $17,000, to have handled 212,000 yd. in 45 weeks, at an apparent cost of 6.7c. per yard and with a saving of 11c. per yard. The gravel figures out to have been 4 yards deep. What I would like to find out is what type and make of dredge this was.

The costs are sufficiently low for a larger boat, the depth of gravel very small, and the stated dividends on the total operation in all about $50,000 above the costs of the boat, etc. There are many localities where such a small installation would pay very well, but I do not know of any company building such an effective machine, therefore the details would be interesting.

JAS. W. NEILL.

Pasadena, April 29.

[We hope one of our readers in New Zealand will send us information on this subject, and particularly as to the character of the gravel dredged. Such light construction as the low price would indicate suggests that the conditions were not severe, and that the gravel was probably quite loose and free from boulders of the size commonly encountered in ordinary dredging operations.—EDITOR.]

The Whiskey-Water Barrel.

The Editor:

Sir—Having just returned from a professional visit to one of Nevada's new mining camps, where water is hauled 12 miles from the railroad station in whiskey barrels, I write to ask, in the interest of prospectors generally, and of occasional visitors to such camps, if among your friends there is anyone who has enough knowledge of the chemical reactions that take place in a whiskey barrel to suggest a remedy for the awful taste that such barrels give to the water. While this taste is as lacking in substance as things in "The dream that I dreamed I was dreaming," yet it is as persistent and searching as the alkali dust on White Plains in summer.

On this trip I found a prospector who claimed to be Mr. Harriman's partner. On being asked for an explanation, he said that on one of his trips he found a mine and shortly afterward learned that it was on railroad land. The old prospector seemed to feel that he would not receive from his partner, Mr. Harriman, the consideration that he would be sure of from a partner whom he could reach and shake hands with. Up to this time, Nevada's prospectors have as a rule selected a line 20 miles on either side of the railroad for their prospecting, as they have had no means of knowing which were the odd and even sections, and they, as a class, were not given to taking chances with partners the color of whose eyes they did not know.

Next to the whiskey barrel question, I think your desert friends would be glad to have you throw light on the attitude of the railroad companies toward prospectors who discover mineral of value on railroad lands.

G. McM. Ross.

Stockton, Cal., April 27.

Mining Education.

The Editor:

Sir—The letter by Mr. John A. Reid in your issue of January 18 has brought beyond the saturation point my interest in your original (in two senses) suggestion at the dedication of the new mining building at the University of California; and some of it has crystallized out. Allow me also heartily to second your suggestion. The need of some such arrangements is so obvious that it is not worth while to say more; the details of a plan to put it into effect are not properly our concern. So let me comment on some aspects of the proposed arrangements from the professor's standpoint.

In choosing a college professor it may be accepted that in the first place he should be a man of high standing in the theory and practice of his profession. In addition, he must be an educator, that is, one skilled in the art of imparting knowledge to others. A further quality desired by all institutions, and demanded by the larger ones, is the ability to perform and direct research work. A triple benefit is derived by the school from this: the published researches of its faculty draw attention to it and give it standing; the intrinsic worth of the man is increased by his original work; and it is not illogical to assume that a man who can do original work in science can develop his department along original lines. There is, at times, a tendency for schools to get top-heavy in the matter of research, just as students often spend more time on athletics than is required to keep them in the best physical condition, but in neither case is it practicable or wise to cut down the amount too much. The professor must be executive enough to administer the funds of his department to the best advantage, and diplomat enough to secure advantages for it without antagonizing trustees, faculty, or students. A most important final quality is the possession of personal traits such as will make him agreeable to his associates—best summed up by saying that he must be a gentleman.

Supposing that we have caught a perfect specimen of this kind, let us follow his life through a few years in order to observe the forces acting on him and their effects. With the advent of autumn we find him lecturing to classes, overseeing laboratory work, directing the research work of his graduate students (which usually means doing the larger part of it himself, except the manual labor), and whipping into line that never-failing portion of the class that fails to see why they should not be allowed to skip the work of the first two years, begin with the advanced lectures in mining and metallurgy and so,

like Jonah's gourd, blossom forth in a night. Besides this, there are the special arrangements to make for men coming from other schools (no small matter in a large school), the committees in endless variety, each of which demands both time and mental effort. Then there is the preparation of papers and lectures for learned societies, the carrying on of some favorite research, the thousand and one small social duties that the 'practical' fellow managing his mine halfway up Lone mountain is blissfully unconscious of; and if our professor can squeeze in a few games of tennis, and a night or two at the theatre to keep his system and intellect normal he is to be congratulated. If he is conscientious about keeping up with the periodical literature of his profession, perhaps he will be able to manage it while waiting for his breakfast or going to his work in the street-car or train.

With the summer months there comes a summer school. The arrangements for this have been crowded into the winter's work, and the work of it uses up the larger part of the summer. What little is left will be devoted to a bit of professional work, to bridge the gap between the small salary and the large interests of the man. Year after year passes thus, each adding to the entangling mesh of small duties, which, unless carefully restricted, will soon hamper his larger work. Last year's lecture notes will have to do for this year, because there is no time to revise them; until they get to be the notes of ten years ago. He views with dismay the pile of unopened periodicals on his study table, and bribes his small son to open and pile them up. He wonders will he ever get the time to see that new process in operation, away off in the back corner of Mexico, while South Africa and Australia are as far away as the New Jerusalem.

Eventually he gets a sabbatical year, if he is fortunate enough to be at one of the few institutions where it is actually given. But his good fortune will probably not extend so far that there will not some special duty arise to demand his time, or perhaps something goes wrong in his department, so that he cannot leave that year. Pretty soon his joints get stiff, and climbing mine-ladders is no longer as easy as it once was. By this time his kind friends will have begun to dissect him with caustic criticism because he is "too theoretical."

The proposed arrangement would remove all this at one fell swoop. The absence from the school would prevent the hampering by petty duties. The conduct of the work by another man during his absence would prevent the persistence of any features in the work of the department that are not justified by general experience. Above all, the time devoted to travel will enable him to gain a first-hand knowledge of the operation in every phase of his profession to a degree that is now impossible to even the most widely traveled consulting engineer. The desirability of this is so obvious as to need no comment.

A word more as to the entire justice of the criticisms so frequently heard of the college professor and what he accomplishes. In the first place, it is amusing to note that there seems to be a more or less general belief that the college professor somehow is not just the comomn variety of man, but a sort of *lusus naturae*, that has sprung into being in some unknown and adventitious way. There is a typical sort, well known in comic journals and to the 'practical' man, although in an academic experience from Manhattan to Cathay I have never encountered one. Mr. Reid's description is strikingly graphic. I can see this professor as he sits immersed in books, his pallid brow lit by the flickering study-lamp, while outside pulses the "deep throbbing life beyond college gates" of which he "never comprehends actual living conditions in the larger world of labor!" I can also see the expansive smile on the faces of such men as J. F. Kemp, E. D. Peters, and others, as they read it. I wonder why people believe in sea-serpents, typical college professors, and other freaks? Did anyone ever really see one?

The real facts of the case appear to be that the typical college professor is an ordinary sort of man, peculiar only in that he believes it better to be useful than to be rich. He has generally had a wide experience in practice before devoting himself to teaching, and would always devote some of his time to practice, if that were practicable. The criticism that his teaching usually is not sufficiently close to present-day practice is just, though frequently exaggerated. It is an inevitable result of the present state of affairs. A man perfectly equipped for teaching if he devoted himself wholly to teaching would in five years be just five years behind present practice. Something can be done to prevent this by keeping closely in touch with the periodical literature of his profession, but for purposes of instruction this is quite inadequate unless supplemented by frequent visits to the scene of operations. The head of a department usually has but little time for the former, and none for the latter. Mr. Rickard's suggestion covers the case amply.

While Mr. Rickard is bearing the aegis for the head professor, let me say something regarding the younger men in the department, who presently become head professors, in the same or another school. Several of our technical schools have the vicious habit of appointing members of the senior class as laboratory-assistants, and promoting them slowly with small increases of salary, in a semi-military fashion, until in their old age they attain the headship of a department. This is a two-fold mistake; the slow promotion causes the ambitious men to try their fortunes elsewhere, and the inbreeding that results from putting men in charge of a department that have themselves been trained in it, is absolutely certain to develop a case of intellectual cretinism. Nothing could be better devised to prevent the free growth of the school. As far as is practicable the placing of recent graduates of a school on its own teaching staff should be avoided. Another thing needed in most schools is a larger salary for the younger men, large enough so that the present persistent temptation to leave teaching for more lucrative work shall not be so powerful. A young man of means without responsibilities can afford to ignore this, but the best men are frequently

without means and with responsibilities. A great deal has been said about the small salaries of college professors, but after all this is not so remarkable a matter as might appear. When men work for the love of their work and not for the money there is in it, it is to be expected that their salary will be largely paid in the commodity they most desire.

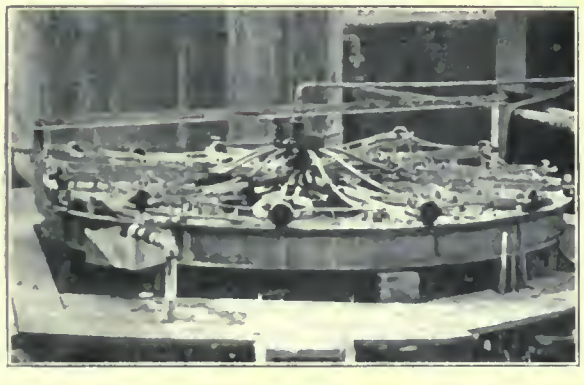
THOMAS T. READ.

Imperial Pei-Yang University,
Tientsin, China, February 26.

The Ridgway Filter.

The Editor:

Sir—I am enclosing photographs of the Ridgway filter, hoping that they will be as interesting and instructive to your readers as the machine itself was to me. This particular machine is placed in the Pastita cyanide plant of the Guanajuato Development Co. as an initial unit, to be supplemented by others after this one has demonstrated its ability to treat the slime. These filters are all set up in the factory in England before shipment to customers, and the mechanical operation of the filter (*not* filtering slime) is perfected. The machine is beautifully made. I



The Ridgway Filter in Elevation.

am not violating confidence in quoting Mr. Joseph MacDonald as saying that it is an almost perfect machine from a mechanical point of view. The filter leaf is a flat iron plate cast with corrugations on its under surface. This under surface has an area of over three square feet and is covered with canvas, which serves as the actual filtering surface. These leaves, 14 in number, are arranged to be lowered into pulp during part of their revolution, raised over a partition, and lowered again into a second trough. This second contains water (or solution) for displacing the retained metal-bearing moisture in the slime. The raising and lowering is effected ingeniously by the irregular arrangement of the outer track upon which the leaves are supported. At the moment that the leaf is lowered into the pulp after passing the discharge-hopper the vacuum-valves open automatically. The air-pressure valves are to be opened by a roller-cam when the loaded leaf reaches the discharge-hopper and these valves are timed to the fraction of a second, as are the vacuum-valves. Three of these leaves are continuously immersed in pulp. The compressor that provides the compressed air for discharging the slime is of English manufacture and is well made and efficient. The vacuum-pump is a double vertical supplied by the Cyanide Supply Co., of England, and is the proverbially well made, neatly finished, and efficient machine from English shops. I omitted to mention that the slime and wash-solution compartments are provided with 10 slow-moving agitators driven through stuffing-boxes from below by a series of cut gears of excellent workmanship with probably very slight friction and wear. The machine has been erected and ready to run for several months, and I cannot emphasize too strongly the excellent workmanship, construction, and materials used.

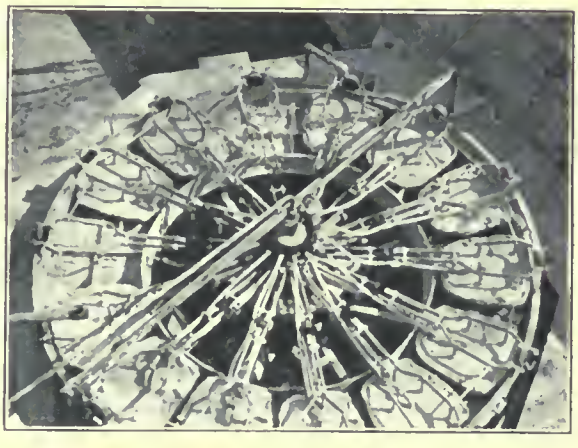
MARK R. LAMB.

Guanajuato, Mexico, April 24.

Submerged Facts and Filters.

The Editor:

Sir—The fact that mining and metallurgical publications have, during the past few months, contained several articles and advertisements relative to the exclusive ownership of submerged filters and the details of their construction and operation, suggests



The Ridgway Filter in Plan.

that something may yet be said, without impropriety, by those on the outside.

There is no general opposition to the proposition that the man who shows to his fellow-workers a better method or mechanism should receive compensation through the patent laws for the novelty involved in that service, but the public justly resents the patenting of ancient and generally used methods.

Submerged filters long since outgrew protection under patent laws. I made my first acquaintance with them in the year 1865, when the knapsacks of soldiers returning from the civil war were opened for the inspection of the boys at home. A porous clay block, connected with a mouthpiece by a rubber tube, enabled the soldier to lie down by any muddy pool and get a drink of clear water. It may not be unreasonable to assume that no filtering has ever been done without submerging the filter, as the outer and inclosing wall of liquor, however thin, is always present during filtration.

About thirteen years ago millmen were working upon the problem of the separation of slime from liquor in cyanide practice. My own efforts in that direction date from that time, and I remember with

more amusement than pride the variety and extent of the scrap-piles that mark that particular pathway. After going to the limit in centrifugal separation, I turned to suction, and drew the liquor through all kinds of filters into cylinders, cones, and boxes, removing the adhering slime-tailing by various devices. Perhaps others approached more closely to the achievement of a sensible working plan and mechanism than I did, but my own methods and appliances were, in the light of the present, crude and not feasible.

In my opinion, George Moore's great service to the cyanide milling industry consists in his truly valuable conception as to the size and shape of filter-cells, making possible the assembling of large filter-area to be handled as a unit. Slime treatment in American metallurgy was not successful until Mr. Moore gave us his shape of cell, and that form of filter-cell remains a basic principle in the present perfected vacuum-filtration. The many mechanical imperfections in the early construction defeated his purposes and, in his first important test, at Mercur, Utah, condemned his process.

The writer, believing that Mr. Moore had outlined the best system for slime-filtration so far discovered, and that the bad mechanical features could be corrected, advised J. V. N. Dorr to investigate the process and to install it in the Lundberg, Dorr & Wilson mill, then being built near Lead, South Dakota. After study of the Moore slime method, it was adopted by Mr. Dorr, and at his mill the first success was made with the system. Mr. Dorr eliminated much of the original crudeness of the Moore plant, but even after his improvements were introduced there was trouble at various points, and the filter-cells remained so unsatisfactory as to threaten the final condemnation of the Moore slime process.

After study of the process as operated by Mr. Dorr, I was convinced that Mr. Moore's inspiration as to the external shape of filter-area made success possible for vacuum-filtration in cyanide practice, and that his cell construction must be radically changed, and his plant for freeing the filters from the adhering slime-tailing greatly improved, before his system could become useful. Immediately after my observation of the work at Mr. Dorr's mill, I made and used the first perforated iron-pipe framed filter-cell that was ever designed or put into service, and for the internal air-pressure adopted by Mr. Moore for discharging the tailing, I substituted internal liquor-pressure under low head.

The fact that the iron-pipe cell-frame and the internal liquor-pressure are vital to the success of the system in question; and that those new features retrieved from failure vacuum-filtration as applied to cyanide mill-work, have been proved by the failure and abandonment of Mr. Moore's cell-frame and internal air-pressure, and the adoption and present general use of my perforated iron-pipe cell-frame and internal liquor-pressure.

Since satisfactory results in operating filter-cells are dependent upon the incorporation of these latter features, the two leading vendors of slime-filter plants and mill-rights are using them, although both of these companies know that the points are covered by my patents.

The foregoing may have been, hitherto, a submerged fact to many users of my iron-pipe cell-frame and internal water-pressure, but as that fact is soon to become a subject of agitation, and as the matter is of considerable importance to mill-managers who are employing the filters in question, it seems proper at this time to make the above statement.

G. A. Duncan.

Nelson, Nevada, April 22.

Life-Saving Apparatus.

The Editor:

Sir—In your issue of April 4, under the heading 'Concentrates,' you say "Helmets such as are made for rescue service in mine-fires are not trustworthy and are good only for short periods of time. As built they are too cumbersome and hinder the vision of the wearer." It is admitted that many of the types of helmets now used are open to adverse criticism because of the faults mentioned, but it is hardly fair to class all types together and to condemn them as a whole. The following description is an account of efficient work performed in a fire in the Schoenberger mine of the Pittsburg & Westmoreland Coal Co., near Pittsburg, by the Draeger life-saving apparatus.

The fire started on December 23, 1907, and had the Draeger helmet been brought at once into use it would, in the opinion of many of the coal company's foremen, have been possible to stop the conflagration in a short time, with a consequent saving of much money. The situation underground, when the stoppings had to be put up, can be best comprehended from the enclosed illustration. The first opening of the second wooden door (in order to approach the place where the intended stopping or bulwark had to be put up) was made on Tuesday, April 7. An enormous amount of dense black smoke and a very great heat was found inside; at the same time the place was so muddy that the men wearing the apparatus sank nearly up to their hips. The first intention was to put up a stopping made out of mud and cement, which was supposed to get dry in a short time on account of the enormous heat. After some exploration work, which showed the fire burning at a distance of about 20 ft. from the intended stopping, and after working on this stopping for a while, the supply of oxygen ran out and the work had to be abandoned.

On the morning of the 10th at 1 o'clock a sufficient new supply of both oxygen and cartridges had arrived from New York, and work was resumed at once. On re-opening the second safety-door it was found that the fire had made headway to within 8 ft. of the place where the stopping was to be erected. The dense black smoke had disappeared and the fire gave good strong light, so that the men could see very well, especially as the electric safety flash-lights and hand-lamps were aiding them. This was a great advantage, because at the first trial on Tuesday only the Draeger safety-lamp gave a sufficiently strong light to penetrate the dense smoke. A further ad-

vantage was the fact that on account of the enormous heat the mud had dried, and therefore the men were able to move around more easily.

Conditions being more favorable, it was decided to erect a wooden stopping; this was done after about an hour's work, and it proved so air-tight that the solid brick stopping, which was then put up, could be worked upon without wearing apparatus. The whole work was done by men who had not even seen the Draeger apparatus before putting it on, and none of the men, notwithstanding the fact that they had to work in a heat of 130 to 150° for a considerable time, felt any the worse for having worked with the apparatus when putting up the wooden stopping, and they were afterward able to put up the brick wall. By administering pure oxygen to the men from time to time, when the enormous heat had weakened them, a great relief was felt, and not enough importance can be given to the fact that all coal mines should keep a small supply of compressed oxygen always ready for use on such occasions.

W. E. Wingramm.

New York, April 15.

Valuation of Mining Shares.

The Editor:

Sir—The communication of Mr. Newton B. Knox on valuing mining shares deals with the subject which is most vital to the existence of gold mining as a permanent and profitable business.

With the exception of a few restricted areas where certain persons still attract the unwary by a sort of mining slap-stick performance, goldfields are now generally exempt from mere wild-cat speculation. Certainly the great mining fields of the Witwatersrand is the last against which the charge of wild-catting can be brought. There technical advice has been the soundest, and mining methods have ever been the most elaborate, expensive, and modern. Volumes have been written concerning ore-reserves, and columns of figures relating to Rand mining costs have for the past fifteen years adorned the pages of technical and financial journals. Therefore the data recently published by G. A. Denny, and by the General Committee of the Transvaal Chamber of Mines, generally unfavorable to the future of the Rand mines as a field for investment, are unwelcome to the persons most directly concerned, and a surprise to the public as a whole.

Mr. Knox notes the failure, on the part of many investors, to appreciate that in gold mining ventures, the payments annually retired to sinking fund cannot be assumed to draw large interest. It is generally and justly considered that a gold mine must pay from 10 to 20% per annum on the investment besides redeeming the whole capital required, the difference in the amount of interest required depending on the situation and life of the mine considered. But to assume that anything above ordinary bank interest can be obtained on that proportion of the annual returns which is set aside to redeem capital is undoubtedly wrong.

Estimates of the gold production of the Rand have been made by several different authorities since 1893. In that year Mr. Hamilton Smith estimated the future production at £325,000,000, basing his figure on the probabilities indicated by the development at that time. Messrs. Hatch and Chalmers estimated a future product in 1895, of £700,000,000 to a depth of 3500 ft., taking a considerably higher recoverable value per ton than is now conceded. The estimate made in most detail was that of Messrs. Leggett and Hatch in 1904. Assuming that the annual product would be £30.000,000, that the main reef would be worked to 6000 ft. vertically for a length of 46 miles, the life of the field would be 42½ years, and the product subsequently to 1902, £1,233,560,709.

Considering the Rand as a whole, with 66 companies producing gold, the product up to the end of February of the present year had been slightly over £200,000,000. Although gold has been produced since 1884, no operations of great magnitude were begun until 1893. Allowing for the interruption of the war, the Rand has had a practical producing life of 13 years. Using as a basis of computation the Report of the Mining Industry Commission and the figures quoted therein from the Report of the General Committee of the Transvaal Chamber of Mines, it appears that the average future life of the 64 producing mines operating at the end of 1906 was 12.66 years. For the establishment of these mines £29,234,836 had actually been subscribed, not allowing for the excess capitalization caused by the rise in the price of shares subsequently to the formation of the companies.

Up to the close of the financial year of 1906, 39 of these companies had paid £38,132,657 in dividends, 25 not having reached the dividend-paying stage. Against the dividends paid must first be charged the payments to sinking fund before interest can be allowed.

As the above figures represent what the Rand mines have actually accomplished, according to the latest authentic data, what is the outlook? Taking into consideration the unfavorable labor factor, which unfortunately is largely beyond the control of the technical advisors, it is not likely that a capitalistic regeneration of the Rand, necessary to the opening of new mines, excessively deep levels, etc., will be forthcoming. Consequently it is fair to consider the life of that territory on the basis only of those mines already opened, equipped, and producing. It is reasonable to allow a life for these of 12 years longer.

Assuming a total life of 25 years for the producing mines, and the total necessary working capital at £30,000.000, a very moderate estimate in view of past expenditure, it appears to me that a justifiable approximation to the actual conditions in this goldfield is given. In order to return 10% on a 25-year investment of £30.000.000, plus the amount necessary for amortization at 3%, the sum of £3,822,000 must be annually paid as dividend. The total in 25 years is £95,550,000. In the past 13 years the dividends should have aggregated £49,686.000. The actual dividends to the present are approximately £43,000,000. Thus in the next 12 years the sum of £52,550,000 must further be paid out in dividends in order to

make up the required total. Taking the total gross output to the present as £200,000,000, and for the future reekoning an annual tonnage of 18,000,000 tons at 30s. per ton gross reeoverable value, we should expeet as the gross recoverable amount in 12 years to eome £324,000,000, or as the total for the assumed 25 years, £524,000,000.

In other words, the annual dividend requirement would on this basis amount to 18.4% of the amount produced, figured on the whole life of the field, the other 81.6% being the amount allowable for expenditure as working cost. How does this requirement eompare with the results? Up to the present the working cost and disbursements other than those allotted as dividends have consumed only 78.5% of the gross. This figure is a less amount than is allowable for the eurrent expenditures of production; in fact, for the future, owing to the enormous tonnage handled, an allowance of 83.8% ean be made as the proportion of the whole, applicable other than as dividends. This is of course providing that the total future produetion comes up to the figure above given. Only 38% of this product has so far been fortheoming, although 52% of the time has elapsed. Granting, however, that the future produet continues at the present rate of £27,000,000 annually, and is maintained for 12 years, the Rand would appear, on the £30,000,000 eapitalization basis, to fulfill the proper eonditions for a 10% long-life investment.

It will be granted that the conditions assumed for future tonnage and yield of the ore are as liberal as one is justified in allowing. But apart from these considerations, how many other faetors must the average Rand investor look to. In 1906, according to the authorities above referred to, the total eapital invested in the shares of the 64 mines was £70,496,-408, or more than double the amount of money represented by the par value of the shares. Aecording to the list of eompanies given in the 'Mining Year Book,' the highest value of the issued shares in 1901, of the 61 eompanies most nearly representing those now produeing, was a total of very close to £100,000,-000. This is praetieally the highest valuation attained at any time in the past.

How serious a matter, from the standpoint of the investing publie, the inflation of the shares of these eolossal enterprises is may be easily eomputed, taking the period from the close of 1901 to the elose of 1919, say 18 years, as a life, and £100,000,000 as the capital on which 10% interest plus 3% amortization must be paid annually.

Today, the total capitalization represented by the current price of shares of 63 produeing mines is £63,600,000. In order to amortize this capital at bank rate and pay annual interest of 10%, annual dividend of £10,843,800 would be required from now on, implying a total gross production, allowing eurrent expenditures to use up only 78.5% of the whole, of £605,235,350, or in other words a greater total production in the next 12 years than the total possible produetion in 25 years.

Aside from the intrinsic possibilities of the Rand, it is also a matter for concern that at the very time when strenuous efforts are being made to reduce working costs below 20s. per ton, the Mining Industry Commission introduces a discussion of the labor problem, accompanied by no satisfaetory reeommendations as to its solution. For all the voluminous exhibits of the commission in favor of supplanting the black by white labor, no very eonvineing arguments as to the ineffieiency of black labor are advaneed. Referring to one of the reeommendations, it is pretty safe to say that the time when the black miners of the Rand are replaced by one-quarter the number of happy Californians is a long way in the future. The deerease in value of the ore as depth is gained is a factor of ever increasing seriousness. Gold mining fields afford few precedents to indicate that the value of ore remains eonstant with depth. Those deep-level mines of the Rand whieh ean maintain an average reeovery of 30s. per ton until their ground is exhausted will probably represent the exception rather than the rule. And it does not seem likely that over the whole field we may look forward to the time when ore eontaining under 25s. per ton reeoverable value will be regarded as payable.

In individual instances there are undoubtedly still to be had sound investments among the Rand companies. Especially is this so in the case of eompanies holding large rather than small numbers of elaims. In the case of large acreage holdings, the danger of oeeurrence of large and irregularly dispersed areas in the reef, 'patches' as they have been called, of ore below the pay-limit, is minimized. And it is undoubtedly true that some properties are mueh better managed than others, and consequently working eosts are lower. But the investing public whieh reads Kaffir shares at par as paying a fair but not an extraordinary interest, is not going to buy these shares at from one and a half to three times par value, with the knowledge that the life of the investment is not long enough to return the requisite amount in dividends.

One factor tending to the increase of eost of produetion on the Rand may be suggested. The vast industry which has been built up in that field has sueceeded in adding to the world's supply of gold over £200,000,000. A marked inerease in the amount of gold means a world-rise in prices of commodities. The Transvaal, a region isolated from eentres of manufacture, and only partially enriched by those natural resources neeessary to the mining industry, is among the first to suffer from each new rise in the price of supplies whieh it must eonstantly obtain from the great markets of the northern hemisphere.

C. W. Purington.

London, May 2.

Acetylene lamps have many advantages for use in mine surveying. They are free from the grease so troublesome in soiling note books, and the small bright flame is a better 'sight' than the ordinary lamp.

Sulphur constitutes 0.04% of the outer 10 miles of the earth, including in these 10 miles the original roeks, the waters, and the atmosphere. The waters of the oeean eontain 0.09% of sulphur, and the original roeks average 0.03 per eent.

Concentrates.

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

The word 'fault' is loosely used to indicate not only the fact of dislocation of rocks, but the surface or zone involved in the dislocating movement. There is, however, no warrant to be found in the dictionaries, nor among the best writers, for applying the word to anything more than the dislocation or interruption of continuity of the rocks affected by a disrupting movement.

Finished iron or steel may be softened, without damaging the finish, by the following method: Prepare an iron box lined with fire-clay. In it place the work, completely surrounded and covered by shavings of the same metal as itself. Seal the box tightly with fire-clay luting, heat it gradually to a red heat in a closed furnace and allow it to cool before removing from the furnace.

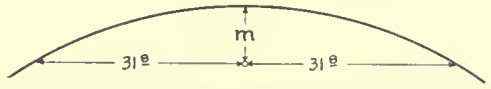
Extra-lateral Right.—The owner of a properly located lode mining claim may follow his vein on the downward course into and underneath the surface of an adjoining mining claim. In doing so, however, he must keep within the plane of the vein, or at least follow it. He cannot leave it and cross-cut into his neighbor's ground, nor run cross-cut tunnels in the property of others simply because this method is the most convenient one for working the claim.

Plasticity in clay is due to the development of a colloidal substance of a gelatinous character which forms from the hydration of aluminum silicate. The particles of this 'colloidal clay,' as it is called, are stated by recent investigators to possess a diameter of approximately one-thousandth of a millimetre, and to have the form of scales, on account of which they acquire a peculiar motion, known as the 'Brownian' motion, in water, which greatly retards the settlement of slime in which this colloidal substance is abundant.

Manganese, as oxide or hydroxide, exists in all deep-sea deposits, sometimes as grains in the ooze, sometimes as a coating upon pumice, coral, shells, and often in the form of nodular concretions around a nucleus. The origin of these nodules is doubtful. Their derivation from the subaqueous decomposition of volcanic debris is the more generally accepted theory. The nodules occur in close association with altered volcanic materials, and most abundantly in connection with red clay of similar origin. In composition they range from 4 to 63% manganese oxide.

Bacterial influences may be present in the upper parts of some veins, but we are not aware of any investigations upon this point. The bacterial fermentation of organic matter present in the vein would have the effect of reducing ferric to ferrous hydrate, and this to a greater or less extent would be dissolved by waters carrying CO_2. The iron dissolved as ferrous carbonate would be re-oxidized to ferrous hydrate in the presence of oxygen absorbed in the solution. It would then be precipitated and would readily form nodules, concretionary masses, or incrustations around open spaces in the lode-matter.

The degree of curvature of an existing track is often desired when no surveyor's transit is available, or without using the laborious process of chords and



deflection angles. By the following method, requiring only a tapeline and a two-foot rule, this may be ascertained with an accuracy dependent only upon the care used. Measure the mid-ordinate, m, (see figure) of a chord 61.80 ft. long. The length, in inches, will be the degree of curve.

Concentration by flotation in the oil-vacuum or Elmore process, depends, first, on the attraction between metallic sulphides and crude petroleum, and second, on the attraction of air or gas for the oil, whereby any gas present will attach itself to the oil-covered particle of pyrite and lift it by 'ballooning.' In practice, water is decomposed electrically in the presence of the oiled sands in a vacuum-chamber, after which treatment a vacuum is produced above the pulp, thus greatly augmenting the lifting power of the bubbles of oxygen and hydrogen produced. Also sulphuric acid may be employed to disengage CO_2 or H_2S when carbonates or decomposed sulphides are present in the ore. Usually 20 lb. of H_2SO_4 per ton of dry sand is sufficient. The acid also cleanses the pyrite, causing the oil to coat it more readily. The scum of sulphides floating on the surface is drawn off by suitable mechanical means.

Mineral wool is the product obtained by forcing a jet of steam or air against a stream of molten slag or molten rock. The molten material is blown out in the form of small spherules from the main stream, each one, comet-like, carrying behind it a thread of the material. Under proper control of the jet of air or steam, it is possible to produce a product having a large proportion of the threads or fibres and only a few spherules. The resulting product is a non-conductor of heat and sound, and is therefore largely used for covering steam and water-pipes, for lining safes, cold-storage plants, partitions, and the like. Mineral wool is most commonly made from slag. The earlier product was objectionable because of the sulphur it contained. When used in damp places the moisture acted on the unstable calcium sulphide in the slag-wool, forming sulphuric acid, which attacked the metals in contact with it. This difficulty has been overcome by re-melting the slag in a cupola furnace, reducing the sulphur to about 1%. Ordinary mineral wool weighs about 12 lb. per cubic foot, and contains 92% voids. It costs in New York about 1¼c. per lb. So-called 'extra' mineral wool weighs about 9 lb. per cu. ft., contains as high as 96% voids, and costs 4½c. per lb. at New York. In estimating the quantity of wool required for filling, allow 1 lb. per square foot for each inch in thickness for ordinary wool, and ¾ lb. for extra wool.

GOLDFIELD, NEVADA.—IV.

Rich Ore and Its Moral Effects.

Written for the MINING AND SCIENTIFIC PRESS
By T. A. RICKARD.

Rich ore invites theft. Wherever men find minerals so valuable that a small weight of it represents money, there the temptation to steal is inevitable, the weak guard of conventional morality is broken, and the conscience of the miner is debauched. It does not matter whether it be an old mining community like Bendigo, with its art gallery and botanic gardens, or a younger and richer district, like Kalgoorlie, or an even more recent and more extravagant camp, like Goldfield; in every case the sight of gold, or of the minerals that are known to enclose it, provokes industrial kleptomania. In Colorado and Nevada they call it 'high-grading,' that is, the removal of high-grade ore from the possession of the mine-owner to that of the mine-worker. The man that is guilty is called the 'high-grader' and the purchaser of the stolen goods is called a 'fence,' the word meaning originally a place of defence against the officers of the law. 'High-grading' is larceny.

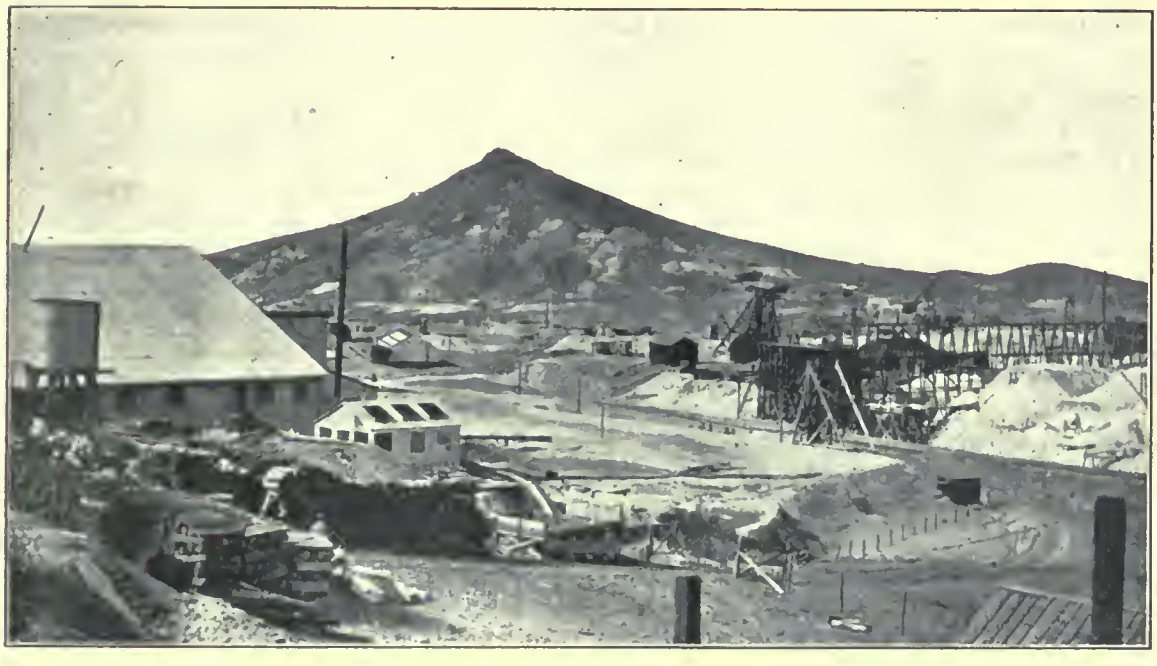
To understand the extraordinary freedom with which rich ore was stolen at Goldfield, it is necessary to appreciate the peculiar labor conditions prevailing in this part of Nevada during the time when the bonanzas in the Mohawk, Red Top, Combination, and Florence mines were being exploited. Mining operations were conducted under leasehold; the owners of the mines were, for the most part, without experience of mining, they had no capital, and they did not know where to look for ore; so they granted leases to parties of working miners willing to work, and to adventurous operators willing to furnish the money for exploration. The areas controlled by different companies or ownerships were sub-divided into blocks, usually 300 ft. long and the width of a claim (600 ft.), and in order to stimulate speculation the lessees organized stock companies, placing the shares on the exchanges of San Francisco, Los Angeles, Salt Lake, and Goldfield. As evidence of the enterprise of some of the men that are mining at Goldfield, I may mention the lease taken by John Donnellan & Co. on the north end of the Red Top. The ground leased is on the south slope of Columbia Mtn. and near the foot of it; the area is 600 ft. square; the term of the lease is 18 months. The lessees agree to sink a two-compartment shaft to 500 ft. They expect to sink at the rate of 150 ft. per month and to complete the shaft within four months. All the money required for this work was obtained in three days by sale of stock. No better proof could be given of the venturesome spirit of the community. Of 100 leasing companies organized in 1906 and 1907, fully 20 struck rich ore and made big profits for a time. Most of them started with just enough money to pay the costs of incorporation and got the capital for their preliminary development by selling shares. Only one of the leasing companies was a close corporation. Even half a lease was incorporated. This happened to the Lewis Rogers lease, one-half interest in which was incorporated as a company of 1,000,000 shares. It only remains for the individual shareholder to incorporate himself. As soon as the incorporators had organized they went to the local or State banks and borrowed money on their stock, the bank in its turn endorsing the company as a legitimate mining scheme. The wonderful ore discovered in the Frances Mohawk, Hayes & Monette, Rogers, Little Florence, Red Top, and other leases sustained the whole fabric of fictitious finance until the day of accounting came last October, during the panic that involved the whole industrial structure of America. Then the local banks (all save one) shut their doors and the local brokers pulled down their stockboards. The total loss among three banks was fully $1,000,000, while the surviving bank (John S. Cook) had $6,000,000 available. The rate of interest paid by the leasing companies was 1 to 2% per month; the bank officials were interested in the leases and in the stock deals that resulted. The one essential factor missing was uninterrupted prosperity and inexhaustible reserves of rich ore.

The ore was rich indeed. In the Frances Mohawk lease at a depth of 200 ft. there was 8 inches of stuff that assayed $250,000 per ton; it was free gold and calaverite or telluride of gold. The various leases on the Mohawk mine yielded a total of $50,000 per day for 106 consecutive days. One carload shipped to the Selby smelter weighed 47 tons and assayed 609 oz. of gold per ton, so that the shipment was worth $591,637, that is, more than $6 per pound. There were many places in the mines where men knew they were breaking ore worth 10 to 15 dollars per pound. It was easy to steal several pounds of ore. And they did.

At the time of my visit there was not much stealing going on—so I was told—except in the Rogers and Little Florence leases, but these happened to be the only ones in bonanza just then! It is estimated that last summer over $1,000,000 worth of ore of which no proper account was made went out from the Mohawk and Combination mines, and $500,000 to $750,000 from the Florence. Not less than $1000 per day of illicit bullion passed through the United States mint at Carson, even after the Goldfield Consolidated mines were closed down, so that most of it must have come from the two Florence leases (the Rogers and the Little Florence). Only $300,000 was recovered last year for the whole camp, despite every effort to find the stolen ore. It is most difficult to trace the 'high-grade,' for the thieves crush it at once and so destroy the chance to identify the product from any particular mine. Unless identified positively, the legal evidence is incomplete. The stolen ore is usually taken to a bogus assay-office, the proprietor of which pays about 50% of its real worth. The ore is then treated by chlorination; first it is roasted in a muffle and then leached in a barrel with a stirrer. In one case a plant was raided while in operation. The heading assayed 260 oz. gold per ton; the tailing assayed 15 oz. Larceny does not wait on accurate metallurgical method. When the owner of this particular establishment was asked what he intended to do with the tailing, he said that this residue would be sold to a man who intended to salt the oxidized

ore on a neighboring claim. Even when the circumstantial evidence seems convincing, the local justices are afraid to convict; public opinion regards 'high-grading' as rather humorous, the labor unions preach a doctrine by virtue of which a little rich ore is the miner's perquisite,* the rush to become wealthy possesses everyone, and in the excitement the moral law is left high and dry.

It was an orgie of stealing. Regular harnesses were invented for carrying ore under the working-clothes of the miners. They would step from the cage or bucket and stumble heavily laden on their way homeward without being arrested, although the officials knew why they walked so clumsily. One day, for instance, when the men were being hoisted to the surface at the Mohawk shaft, a man came up so loaded with concealed ore that on stepping out of the bucket he fell. The superintendent saw it and to strike the pail of one of his own shift-bosses with his candle-stick and detected a solid sound; he asked the man to go to the second level and perform an errand; then he opened the dinner-bucket and found it full of rich ore. Frequently the sacks that hold the wedges used by timbermen were employed as receptacles for stolen ore. The 'muckers' or shovelers would handle their shovel so as to leave the heavy fine ore on the bottom of the level and as soon as the men in the stopes shouted "fire," which they would do 10 minutes beforehand, the shovelers would have a chance to collect the rich ore while the shift-bosses and other men were on their way out to the shaft. At one time it was a rule that men should leave their dinner-buckets at the office. Some of them came on shift with their food in paper bags so as to avoid going to the office. They were warned not to do so. The next day all of them came with paper bags, and



Combination Mill. Columbia Mt. Mohawk Mine.

Goldfield, Nevada.

called out: "Some one help that son of a gun." In the Little Florence, there was a hoist underground, at the 300-ft. level, and one day the superintendent signalled from a lower level without getting any response, so he climbed up the ladder and found the engineer digging into the bonanza ore in the floor of the level. He was actually getting ready to fire a shot, and had done so previously. In order to escape notice he would time his firing so as to coincide with the blasting in the neighboring stopes, and thus the explosion would pass unheeded. In another mine, the foreman happened to go into an abandoned crosscut and found three carloads of the richest ore lying on a platform ready to be sacked and to be removed through a disused shaft at the far end of the crosscut. Another foreman on another occasion happened the management did not dare to dismiss them. Finally, I may relate the story of the foreman who caught a man loaded with 10 lb. of 'high-grade'; this foreman was notified that there was a watchman paid to do the watching and as he (the foreman) was not a regular watchman he had better attend to his own duties, otherwise the union would have something to say. And thus we come to the root of it all: the subservience of the lessees to the labor union. Why? Because the ore was rich, and the terms of the leases were short, the lessees could not afford to delay the extraction of ore by having trouble with the men: the men knew it, and so stole as much as they could. Everything was sacrificed to a mad rush to make money, the mines were gutted, honesty was swept aside fiercely, the law was made a dead letter.

The rights of property were not respected because the judges who preside over the local courts owed their position to political election, and this made them subservient to the majority of voters, who hap-

*It may be mentioned that in olden days on the high seas the captain's graft was formally recognized and termed 'primage' because he got it first. Nowadays 'primage' is charged in addition to the freight and retained by the ship-owner. The captain does not get it; he no longer participates, he is an employee only. In nearly every industry a similar development can be traced, from open participation to surreptitious graft, and then regulation, which ended all participation in profits.

pen to be mine-workers. Of the mine-owners and operators many have their homes elsewhere, in California, Utah, Colorado, or New York; they do not vote at Goldfield and they exercise scant political influence. Moreover, a large proportion of the lessees who hired the workers in the mines were ordinary miners and laborers themselves, their good fortune was not conceded as due to any superiority of character or talent, therefore the men who were employed thought it reasonable that they should participate in the luck of those by whom they were employed. It was a rough kind of socialism.

The miners stole rich ore, but so did others who might have been supposed to know better. I know of the president of a mining company (not at Goldfield, but in a neighboring district) who used to visit the mine whose operations he supervised and on the occasion of each visit he filled his dress-suit case or valise with specimen ore. Finally, at the end of the fiscal year he told the manager to debit him with $4000. The manager told me that he had kept tally on the little shipments that went from the mine in the president's valise, and he estimated the total value of the ore as being at least $22,000. One of the richest leases at Goldfield was worked by a company organized by a broker; he used to visit the mine in his automobile and take away sacks of ore; it is estimated that he removed $150,000 worth, on which he avoided the payment of the 25% royalty due to the owners of the mine, not to mention the proportion due to the shareholders in his leasing company. Every lease had its sequel of litigation caused by differences of opinion as regards the application of the law of mine and thine. Thus, the Little Florence lessees went 30 ft. over their line and took rich ore from ground not within their lease. In August, 1907, they had to pay the Florence-Goldfield Co. not less than $177,000 in liquidation of a claim for trespass, and were compelled to make a change in the management of the lease operations. When I visited that part of the mine, I found the level barred by a heavy wooden partition placed there to safeguard the rich ore remaining. While at Goldfield I found myself involved in one of these difficulties between lessor and lessee, for I made an affidavit that I found the workings of the Little Florence lease in good shape. According to the terms of the lease, the Little Florence people had to leave five feet of ground under each working level, the idea being that this arch of rock was required to conserve the safety of the workings. I noticed that levels were rather far apart; the first was at 248 ft., the second at 400 ft. from the surface. The question arose whether the ore should be left untouched under an intermediate level. The lease was about to expire (on April 26) and the lessees were gathering all the rich ore that belonged to them. They were also putting the workings in good order, for by their agreement they had to maintain the timbering and hand the mine over in ship-shape condition. I remarked to Mr. Frank Oliver, the manager, that it was a good time to visit a mine when the lease was about to expire, for all the workings appeared so accessible, clean, and safe. The lessees are under compulsion to leave the track in the principal levels, but they may remove piping and tools. Ordinarily they have three months wherein to remove the ore stacked at the surface or in the bins, and to dismantle their equipment. I was in the Little Florence on the morning of April 11. In the afternoon of the same day the Florence-Goldfield Co. asked the District Court for an injunction and cancellation of the Little Florence lease, which was to expire within a couple of weeks, on the ground of improper mining methods and the removal of an arch of rich ore under a level. This was filed on a Saturday after business hours. On a technicality the hearing was deferred to the following Monday morning. Finding that their allegations could not be sustained legally, the lawyers acting for the Florence-Goldfield notified the Little Florence people that they need not appear in court as the case would be dismissed. But before this could be done, the Little Florence company filed a cross-complaint alleging that it was forced to allow the Florence-Goldfield $176,907 that belonged of right to the defendant and to give up part of the lease, or submit to being harassed by the plaintiff so that shipments and operations were hindered. This refers to the old trouble, already mentioned. In the cross-complaint the Little Florence lessees alleged that they had been damaged to the extent of $1,500,000, and asked for this amount of damages. The shares of the Florence-Goldfield dropped at once from $4.27 to $3.95. Such incidents as these, indicating lax notions of property rights among lessees and companies, are not likely to impress the working miner with any marked respect for the possessory claims of either party.

But to understand the extraordinary conditions prevailing at Goldfield last year, it is necessary to refer to the insidious effect of having a stock exchange close to the mines and the participation of owners, lessees, and workmen in the wild speculation arising from discoveries of wonderfully rich ore. The leaders of the labor union were agitators of the worst type, their importance depended upon stirring up strife between the employers and the employees, their opportunity to make money hinged largely on the fluctuations in stocks caused by labor disturbances and the settlement of them. During the strike that was ended in April, 1907, the stock market was worked by the labor-union leaders. They would call a meeting under pretext of settling the strike, and the announcement of this fact would lead to the buying of shares by the general public: they would sell short, and then cover their shorts by open purchases made through their wives; this stimulated more buying; then the counting of votes cast at the meeting of the union would be dragged along so as to afford the time necessary to complete the stock transactions. Thus they see-sawed the market five or six times. This broke the brokers, who had been breaking the public. It was a merciless game of depredation. Never was there a more vivid example of the undermining of character in the presence of wealth: only a few sane men kept their heads in the midst of this scramble for gold, the community as a whole went crazy in the haste to get rich, and threw aside all

the scruples of business morality and even the conventions of financial raseality.

It was amusing to hear the question discussed whether it was proper to leave 5 ft. of ore under an intermediate drift, and whether such an intermediate constituted a level. I found myself no more in sympathy with the lessee who wanted to gut the mine and was willing to precipitate a caving of the workings, than with the lessor who in his greed insisted that ore must be left untouched even though the removal of it could do no harm to the safety of the workings. From the standpoint of legitimate mining it seemed to me that the richness of the ore ought to have little to do with the removal of it, if necessary to hold the workings. The question of removal ought to be decided on its merits, as a problem in practical mining. A well known attorney told me that he had been asked whether the requirement for leaving 10 ft. of ground around the 'sides' of a shaft meant the 'ends' also. He promptly gave instructions to specify the 'ends' in all new leases. A man who risks the safety of his working shaft in order to extract a few tons of rich ore is no miner, and if he is willing to run the risk of injuring a shaft that will revert to the use of, as it already belongs to, the owner of the mine, then he is a thief, just as much as the 'high-grader'.

Thus at every turn the conclusion is reached that the exploitation of ore of unusual richness is subversive of the integrity alike of the man who digs the ore, the lessee whose property it is, and the lessor to whom the royalty is paid. All of them tried to get more than belonged to them; and when they had finished the scramble for their share, the railroad and the smelter levied a toll that was tantamount to highway robbery. There was not much to choose between them all; it was a case of catch as catch can, with the odds in favor of the one who first placed his hands on the ore—the miner himself.

State Geologists.—Representatives of twenty of the State Geological Surveys meeting at Washington on May 13, organized an Association of American State Geologists. Provision was made for an annual meeting and the appointment of various committees for the transaction of the business of the association. H. B. Kümmel of New Jersey was made president; H. F. Bain of Illinois, secretary; and J. H. Pratt of North Carolina was appointed to act with them, forming an executive committee. Messrs. W. B. Clark of Maryland, I. C. White of West Virginia, and J. H. Pratt were appointed a committee to investigate the distribution of documents by the various surveys. J. M. Clarke of New York was appointed to represent the State Geologists on the general committee on nomenclature now being organized, with Samuel Calvin of Iowa, and E. A. Smith of Alabama, as associates.

'Drift' of a diamond-drill may be caused by the use of a core-barrel until it becomes noticeably worn by abrasion. The bit is frequently renewed and is always the same size, while the pipe back of it (the core-barrel) becomes thinner by wear and is apt to sag, thus giving to the bit a slightly divergent course.

The Prospector.

This department makes a charge of 25 cents to subscribers not in arrears and $3 to non-subscribers for each determination.

From D. J. S., Seven Troughs, Nevada: Basalt with pyrite.

From W. C. B., Minneapolis, Minn., a felted aggregate of capillary crystals of black tourmaline in quartz.

From Alamos, Mexico: A quartzose metamorphic rock, perhaps a conglomerate-schist; sample too small for precise megascopic determination.

From W. B. H., Placer county, Cal.: No. 1, badly weathered volcanic andesite; No. 2, hornblende schist, little pyrite; No. 3, badly weathered volcanic, andesite-tuff; No. 4, talcose schist with pyrite; No. 5, hornblende-chlorite schist with pyrite; No. 6, fine-grained schist with magnetite.

From C. E. S., Sweetwater, Nevada: No. 1, weathered rhyolite or andesite breccia; No. 2, diabase with veins of epidote; No. 3, weathered porphyry with pyrite; No. 4, quartzite; No. 5, limonite; No. 6, epidote; No. 7, weathered volcanic rock, pyritized; No. 8, limonite and hematite in acid tuff.

From W. McF. S., Outlook, Wash.: No. 1, vesicular lava, probably andesite; No. 2, quartz and chlorite; No. 3, highly weathered acid tuff; No. 4, coarsely vesicular andesite; No. 5, weathered andesite; No. 6, chalcedony; No. 7, hematite and limonite; No. 8, aplite; No. 9, fine-grained mica schist with pyrite; No. 10, weathered tuff containing limonite, kaolin, and manganese oxide.

Received frim J. W. A., Pioche, Nevada: Complex ore containing embolite (or bromyrite), silver bromide, probably with a little chlorine, as the most important constituent occuring in small adamantine yellow-green crystals of waxy texture; also present are malachite, chrysocolla, hematite, limonite, manganese oxide, and a brilliant white crystalline substance in too small quantity for determination.

Material sent by O. H., San Francisco: No. 1, weathered andesite or andesite-tuff with pyrite; No. 2, pyritized andesitic tuff; No. 3, andesite tuff with pyrite changing to limonite; No. 4, highly weathered tuff with limonite; No. 5, weathered vesicular basalt or very basic andesite; No. 6, greatly weathered basalt or basic tuff; No. 7, fresh basalt; No. 8, fine-grained basalt with few vesicles filled with calcite and silica; No. 9, altered andesite; No. 10, andesite; No. 11, andesite; No. 12, acid volcanic brecciated and charged with silica and pyrite; No. 13, pyritized andesite veined with silica.

Steel bands for transmission of power have been successfully introduced by a firm in Charlottenburg, Germany. Such belts are made narrower and lighter than leather or rubber, and hence may be made to run much tighter and greater lengths employed. It is claimed that slipping is reduced so that an efficiency in transmission of 99% is obtained.

UNCONFORMITY AND DEPOSITS.

Written for the MINING AND SCIENTIFIC PRESS
By OTTO RUHL.

The importance of unconformity in the formation of ore deposits has not received adequate attention until very recent years. So impressed were mining engineers and geologists with the idea that most ore deposits containing the useful metals were always accompanied by dynamic movements resulting in great fissures, faults, and fractures in which the ores were deposited from deep-seated sources through an ascending circulation of ground-waters, that other factors entering into the problem have either been overlooked or misinterpreted. A working hypothesis so easily applicable is also likely to be abused. The empirical method, while accurate, is slow, and on this account the engineer and geologist are prone to the error of distorting the field-facts in accordance with theory rather than accepting the facts and then ascribing them to causes in accordance with them. Some such misinterpretation or misapplication of theory has been brought to the notice of every engineer or geologist. It is my intention to point out here how the application of the above theory completely misconstrued the facts in ascribing an origin for the lead and zinc ore deposits of the Missouri-Kansas district.

The area in question consists of rocks of two ages, the prevailing formation being limestone with included beds of nodular chert of Mississippian age. West of the area, as a fringe, occur the lower coal measures of Pennsylvanian age, lapping over and burying the Mississippian rocks. There are numerous 'outliers' of the Pennsylvanian all over the district, lying in eroded depressions of the Mississippian. Every geologist working in this region has noted the existence of this unconformity between the Mississippian and Pennsylvanian, but the importance attached to it has differed. The evidence demonstrates a long period of erosion after the elevation of the Mississippian and before its depression during Pennsylvanian time. This erosion cut the country into hills and valleys and left on the flanks of the hills and in the valleys great quantities of detrital fragments of chert resulting from the breaking down of the more soluble limestone. The effect of weathering was very great, for the limestones were eroded in huge caverns along joint-planes. Many feet of the limestone beds were taken into solution, resulting in a settling of the overlying beds and a concentration of the chert layers or fragments into huge bodies. This solution took place not only during Mississippian times but continued in some measure to the present day. These caverns and underground water-ways resulted in the formation of sink-holes of irregular shape and extent, which were filled with Pennsylvanian deposits during the deposition of those rocks, and constitute today the remaining outliers after erosion has carried away most of the Pennsylvanian. This fact has been one of the most misconstrued of any observed in this region. These outliers have been explained by saying that they were faulted below the Mississippian in conjunction with the faults that must have occurred in order to account for the circulation of ascending waters carrying the ore. This has appeared more plausible when upon a casual examination it was found that many such deposits show disturbance, even faulting within itself and slickensides along the contact with the Mississippian. Detailed work demonstrates that this jumbled condition is entirely due to solution which, occurring at the base of the shales between them and the Mississippian, causes a settling of the upper beds so as to produce movement and slickensides. No faulting of importance can be found anywhere within the district. The faulting can never be traced down into the bedded limestone. Such faulting therefore cannot provide the means for a deep upward circulation of water.

The solution of the limestones and the settling of the beds have crushed and brecciated the nodules and layers of chert below them. We find these breccias in the 'sheet' ore deposits which occur in beds from 150 to 300 ft. below the solid limestone strata of the Mississippian. These chert beds were therefore within the zone of superficial weathering during the period of erosion. These beds, together with the old talus slopes of detrital chert in the valleys and on the flanks of the hills after the laying down of the Pennsylvanian and the re-elevation of the land surface, formed ideal water-channels for the ground-water and also gave the physical requirements for the deposition of the orebodies. The degradation of the Pennsylvanian ensued and the small quantities of the minerals in these rocks were concentrated by downward circulating waters in the underground water-channels at points where the conditions were favorable. During this deposition the broken chert beds were cemented together with secondary chert and minerals. This mass presented a brecciated appearance, the sharp angular pieces of chert being so firmly imbedded in the cementing substance that upon breaking it the new lines of fracture cut across the old chert and the new as though they were a homogeneous rock. These phenomena of brecciation upon superficial examination were mistaken for evidence of faulting but upon detailed study they were found to be in the one case a conglomerate of the detrital chert, and in the second a solution breccia of the beds of chert found below the surface of the floor of the unconformity; they are therefore wholly the result of unconformity and solution.

Here, in three instances, the effects of unconformity were misinterpreted. First, the unconformable beds were mistaken for faulting. Second, the disturbed conditions in the Pennsylvanian resulting from settling of beds that caused small local faults and slickensides induced the belief that faulting must be deep-seated. Third, the brecciated chert beds were mistaken as additional evidence of such faulting. With these basal facts wholly misinterpreted it became easy to explain all the other phenomena in relation to them. Thus grew up the theory that the origin of the lead and zinc ore deposits of Missouri and Kansas involved deep faulting with wide zones of fracturing, an upward circulation from the Cambro-Silurian limestones, whence it was supposed, on account of the magnesia in the deposits,

A Fault. Slickensides on Chert to be Seen on the Left.

FIG. 1.

Disturbed Conditions in Pennsylvanian Shales and Sandstones, Showing Fault With Throw of 8 Ft., at Oronogo. Mining is Being Carried on Below This at the Contact With the Mississippian and Deeper. The Evidence of Solution as a Cause for These Phenomena is Abundant in the Mine Workings.

FIG. 2.

the ores too must have been obtained, a first concentration of the ores and a secondary enrichment. The theory was beautifully worked up, but its basal structure was completely wrong and when thorough investigation was made it was found to be untenable.

The relation of unconformity to ore deposition is very important to the Missouri-Kansas district, for it makes the district, as far as the physical preparation for the deposition of ore is concerned, co-extensive with the unconformity of the Mississippian and Pennsylvanian rocks. It is true that along the entire edge of the Pennsylvanian in Missouri small deposits of lead and zinc have been found, but nowhere have developments been carried to the extent they have in Newton, Lawrence, and Jasper counties. Late developments in Oklahoma, where the coal measures skirt the Mississippian, have shown a new field for mining. The limitation of the region appears to be therefore confined entirely to the zone in which the degradation of the Pennsylvanian has been sufficient to furnish a workable deposit of ore, and the relations existing between oxidizing and reducing solutions were such as to form this deposit in the favorable places along the unconformity between the Pennsylvanian and Mississippian rocks. The final degradation of the carbonaceous shales of the Pennsylvanian tends constantly to diminish the amount of reducing solutions, and it is a noteworthy fact that the heavier deposits of ore occur in close relation to such beds. As prospecting recedes from the Pennsylvanian the ore deposits become lean and less important unless protected by an 'outlier.' A limitation, which has no reference to unconformity, may be found however in the extent to which the Pennsylvanian rocks have been impregnated with the requisite quantity of ore to furnish deposits in commercially important orebodies. This is a problem for the chemist and geologist to work out together.

If unconformity, erosion, and solution have been the agencies preparing the physical means for ore deposition in so large a field as this, is it not possible that more detailed work in other regions may reveal some such relation there? It may be that many of the phenomena credited to faulting in other districts where the ores are plainly the result of a concentration from circulating ground-water are but the effects of unconformity, erosion, and solution. Indeed, it is not improbable that the importance of unconformity in its relation to the formation of orebodies, especially if the superimposed beds are sediments resulting from a degradation of igneous rocks or sedimentary rocks immediately derived from them, will become a greater factor in the work of the engineer and geologist in the development of new mining districts.

In conclusion, the Missouri-Kansas district furnishes a striking example where even the best trained and experienced engineers and geologists for a long time mistook the effects of unconformity, erosion, and solution, and should teach the lesson that mere disturbed conditions in superficial strata, even when attended with slickensides and breccia, are not incontrovertible evidence of orogenic movements involving faulting to great depths.

A DERELICT.

The Nevada gold country has exerted its allurements in the past, and has witnessed its sacrifices, as appears from the accompanying illustration of a quaint mill for the reduction of gold ores, still standing abandoned in the desert some 45 miles

south of Goldfield in the extreme southern point of Esmeralda county. By the manufacturer's nameplate and other evidences, it appears to be a derelict of expectations wrecked at least 20 years ago. Inside the rocking mortar were two cast-iron rollers, 12 in. diam., the evident intention being to consume as much power as possible with the lowest result, in a place where power-generation would at that time have made the most economical crusher extremely costly to operate. It is a mute reminder of the credulity of man, and of his tendency to follow the advice of the charlatan in mining.

Alabama, although not recognized as a gold and silver producing State, has contributed her small share to the world's precious metals. In the 107 years since 1800, she has produced, according to the U. S. Geological Survey, a total of $760,470. This amount represents an annual production of $7107, but only once in the 24 years from 1880 to 1903 did the recorded production reach this mark. However, in the three following years the amount produced has been:

	1904.	1905.	1906.
Gold	$29,300	$41,530	$24,921
Silver	116	203	83
Total	$29,416	$41,733	$25,004

This increase is due to the renewed activity in the Hog Mountain mine, in Tallapoosa county. In addition to the above mine, those at Gold Ridge, in Randolph county; at Clear Creek, in Cleburne county; at Pinetucky, in Perry county; and the Tallapoosa mine, four miles southeast of Hog Mtn., have contributed to the total production. The mines at Pinetucky were probably worked early in the last century. Along the banks of a small stream are found extensive dumps, apparently old placer washings, in which trees at least 100 years old are growing.

ALPINE AND AMERICAN TUNNEL RECORDS.

The Rieken tunnel headings met on March 30. This tunnel is in the Canton St. Gallen, in northeastern Switzerland, and extends from Uznach to Wattwyl. It shortens the north-south railway routes in eastern Switzerland, though if either the Splügen or the Greina tunnel project goes through, the Ricken will serve mainly local needs. It is 28,221 ft. long between portals. It was begun about the end of 1903, and progressed steadily, with occasional trouble from firedamp but without excessive difficulty until March, 1907, when, the headings being 93% through, a strong flow of firedamp was tapped in both north and south headings. The gas, which took fire, stopped all work for some months, but in July the full-section enlargement and lining operations were resumed, with the use of safety lamps. In October the fire was out and the flow of gas small; the temperature having gone down, work was resumed at the south heading with safety lamps, and since then the work has progressed without serious interruption, until at the end of February, 1908, the headings were only 531 ft. apart. The south heading was advanced this entire distance during the first 30 days of March, making a new record for hand-drilled tunnel progress.

It is interesting to note here a comparison between American and Alpine records for rock tunneling. A list of the more notable performances is given in *Engineering News*, April 2, 1908, from which the above table is compiled.

From a study of the data it is evident that the Alpine records are far ahead of the American. The Gunnison record of 449 ft. with machine drilling is 82 ft. less than the new record of hand-drilled work in the Rieken tunnel. European tunnel constructors universally prefer the bottom heading method, while in America the top heading is always used. Is this difference responsible, says the *Engineering News*, for the difference in maximum progress rates? Or is sufficient explanation found in the greater length of the principal Alpine tunnels, and the resulting economies achieved by installing more perfect plants and arranging a more thorough organization?

ROCK TUNNELING RECORDS.

Name.	Place.	Date.	Maximum progress of a single heading. Ft. per mo.	Method of drilling.	Remarks.
Mt. Cenis	Alps	1857–1870	297	Machine	
Hoosac	Massachusetts	1865–1873	184	Machine	
Sutro	Nevada	1869–1877	417		Probably in one heading
Nesquehoning	Pennsylvania	1871	165	Machine	
St. Gothard	Alps	1872–1881	436		Averaged 343 ft. per month for one year
Arlberg, east heading	"	1880–1883	637	Ferroux percussion	
" west heading	"	"	641	Brandt rotary	
Stampede	Washington	1897-1900	301		Northern Pacific Railroad
Kellogg	Idaho	1898	345	Machine	Bunker Hill & Sullivan mine
Albula	Alps	1900–1902	607	Brandt rotary	
Bosruck	Austrian Alps	1902–1905	546		
Simplon	Alps	1900–1905	685½	Machine	World's record
Tauern	Austria	1902–1907	548		
Ricken	Switzerland	1903–1908	531	Hand	World's record for hand-drilling
Raton	Colorado	1907	412	Pneumatic augers	A. T. & S. F. Railway
Gunnison	"	1908	449	Machine	

'The Strength of Chain Links' is the title of Bulletin No. 18, recently issued by the University of Illinois Engineering Experiment Station. The authors, C. A. Goodenough and L. E. Moore, have deduced, by theoretical considerations, rational formulas for the strength of chains, and have experimentally established the validity of such formulas. The following conclusions, based upon results of the investigations are presented. "The introduction of a stud in the link equalizes the stresses throughout the link, reduces the maximum tensile stresses about 20%, and reduces the excessive compressive stress at the end of the link about 50%. The stud-link chain of equal dimensions will, within the elastic limit, bear from 20 to 25% more load than the open-link chain. The ultimate strength of the stud-link chain is, however, probably less than that of the open-link chain. The following formulas are applicable to chains of the usual form: $P = 0.4d^2S$ for open links; $P = 0.5d^2S$ for stud links; in which P is the safe load; d, the diameter of the stock; and S, the maximum permissible tensile stress. In the formulas given by leading authorities on machine design, the maximum stress to which the link is subjected seems to be underestimated."

O'HARA POCKET MINE.

Written for the MINING AND SCIENTIFIC PRESS
By An Occasional Contributor.

The O'Hara mine is situated in Tuolumne county, a short distance north of Sonora, in what is called the 'pocket' region of California, extending from Sonora northward into Calaveras county, thus including Columbia and Bald mountains. From this zone many millions of dollars worth of gold have been taken in the form of pockets and coarse placer gold and nuggets undoubtedly derived from the erosion of 'pocket' lodes, and it has yielded a large proportion of the finest crystallized gold specimens and gold-tellurium minerals found in the State.

The bonanza of the O'Hara mine occurs in slate of the Calaveras formation near its contact with crystalline limestone. The mine is entered by a very flat incline running west of north, following the dip of a flat dike or sheet of light greenish porphyry; this cuts both limestone and slate, and constitutes the vein. At intervals, certain nearly vertical partings or crossings are found, often no thicker than a knife-blade, which cut obliquely across the shaft or incline. Pockets are expected only at the intersection of one or more of these crossings with the porphyry in a particular narrow belt of black slate, which is probably carbonaceous, and they are also associated with the presence of another intrusive, locally called 'granite,' but which is very fine-grained and is probably an older silicified porphyry. In the porphyry sheet one or more thin seams sometimes occur, approximately parallel with its general direction. When pockets occur, these seams widen out to several inches and contain gold and tellurium minerals in hard white quartz. The richest portions of the bonanza, however, were flat rough masses or irregular slabs of almost solid gold with more or less adhering telluride. Gold sometimes extends also into the mass of the porphyry itself. Near these pockets the flat sheet of porphyry may widen out and spurs from it sometimes break into the slate, which is locally shattered and more or less veined with quartz. The porphyry, the 'granite', and the black slate are more or less impregnated with finely disseminated pyrite, which itself contains but little gold.

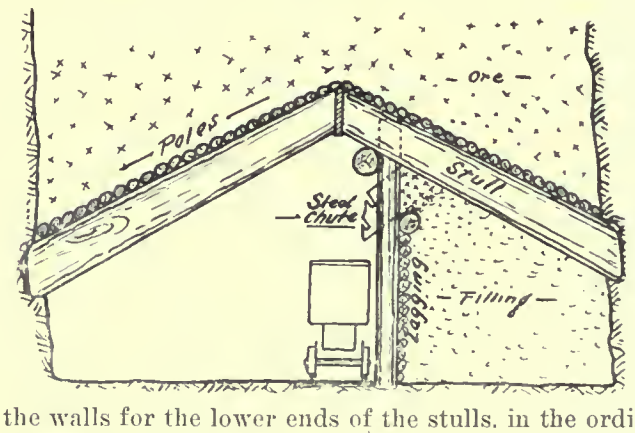
As the gold occurs in and below, but seemingly not above, the porphyry sheet, it is probable that the thin crossings which are partly filled with quartz and some carbonate of lime, have been the channels through which mineralizing solutions have risen until stopped by this capping and have spread and deposited the gold and tellurium mineral. The free gold of the O'Hara pocket mine is fully 900 fine, making the ratio of gold to silver approximately 9:1; and a similar ratio has been found in several other pocket mines in the vicinity. In the telluride of the recent bonanza, however, there is a large proportion of silver, and the ratio of gold to silver is said to be about 1:2½. In other mines of the district there is a wide variation in this respect; some of the tellurium minerals are said to contain silver exclusively while others are practically free from precious metal or at most enclose a little free gold. The gold obtained from the Bonanza mine, in the same district, is said to have run from 825 to 875 fine, but was probably lowered in fineness by the presence of tellurides containing silver.

Little information can be obtained as to the exact value of the recent find, but at least $150,000, and probably double that amount, has been extracted. In addition to this, all the rock in the immediate vicinity of the bonanza will be milled to secure any gold that may occur in the quartz stringers or porphyry.

The somewhat similar mode of occurrence of pockets in the Bonanza mine, situated a short distance away from the O'Hara and in the outskirts of the town of Sonora, has been described in the 8th, 10th, and 12th reports of the State Mineralogist, pages 652, 736, and 299, respectively. The general geology of the district has been mapped and described by the U. S. Geological Survey in the 'Big Trees' and 'Sonora' sheets, as it lies on the boundary of these two tracts.

The large size of many of the masses of gold taken from the O'Hara, the Bonanza, and other mines of the district, amply accounts for the largest of the numerous nuggets found in the adjacent placers, without requiring any theory involving a resolution of the gold in the gravels. The contiguous crystalline limestone, forming the bed of the creeks worked by the pioneers, was most irregularly eroded so as to afford ideal natural riffles which caught any gold resulting from the erosion of the pocket veins before it traveled far enough to suffer much abrasion. How profitable the working of this limestone bedrock must have been, is evident from the amount exposed by the old workings in and around Brown's Flat.

Saddle-back stulls in use in the mines of Kalgoorlie are shown in the accompanying figure. The principle is very simple. Two stulls are cut to fit like the rafters of a roof, with a face-plate between the ends at the angle where they meet. Hitches are cut in



the walls for the lower ends of the stulls, in the ordinary way. In effect, the saddle-back stull is a toggle-joint, and when loaded with waste above the lagging, the load instead of being entirely transverse is resolved into components and the stull acts as a compression member and transmits a thrust against the walls. Thus, not only may wide spaces be stulled, but stulls of smaller sectional area may be employed than would be required for equivalent loads when the timbers were not thus framed.

MINE REPORTS.

UNITED STATES SMELTING, REFINING & MINING CO., BOSTON.

The second annual report of the United States Smelting, Refining & Mining Co. covers the year ending December 31, 1907, for which period the profits amounted to $2,070,213, and dividends of $2,768,580 were paid. Undistributed surplus on December 31 stood at $557,003, against $1,990,572 on December 31, 1906. The metals contained in bullion produced in 1907, including metals from custom ores, but not including the production in Mexico, were as follows:

Copper	38,518,378 lb.
Lead	53,617,324 lb.
Silver	6,739,269 oz.
Gold	235,882 oz.

The income account is as follows:

Metals in bullion produced in 1907		$18,408,654
Deduct selling, commission, and shipping exp.		161,071
Balance		18,247,583
Excess of ores at beginning of year over end of year on hand and in transit		444,646
Balance		17,802,937
Miscellaneous earnings from ore sales, royalties, rentals, etc.		179,156
Total		17,982,094
Cost of production, including custom ores and matte purchased		16,154,513
Net		1,827,580
Miscellaneous revenue		558,959
Total net		2,386,540
Depreciation and reserve	$120,009	
Administration and legal expenses	166,317	
Interest on 6% debentures U. S. M. Co.	30,000	316,326
Balance of profits for year		2,070,213
Previous surplus		1,990,572
Total		4,060,786
Less depreciation in metals unsold at end of year, including metals and ore in process		733,255
Balance		3,327,531
Dividends on minority stock of subsidiary companies		1,947
Dividends on U. S. Smelting preferred (7%)		1,672,348
Dividends on United States Smelting common		1,096,232
Undistributed surplus, December 31, 1907		557,003

The copper produced during the year was sold at an average of 18.83c. per lb., lead at 5.20c., silver at 65.20c. per oz., and gold at $20.56. The ore produced from the Centennial-Eureka, Mammoth, and United States mining properties was 406,748 tons, of which the values of the metal contents were in the proportion of 56% copper, 4% lead, 18% silver, and 22% gold. At the Mammoth plant in California there have been completed, during the past year, the enlargement of the smelter; the construction of the converting plant; the construction of the railroad to connect the mine and the smelter, and the construction of the railroad to connect the Quartz Hill mines with the Southern Pacific railway. These are now (April, 1908) all in operation, and will nearly double the smelting capacity at Mammoth, and permit the converting of Mammoth matte into copper bullion at that plant in place of shipping the matte to Utah to be converted as heretofore. Another important advantage is that with the increased smelting capacity, and a converting plant at Mammoth, the Centennial Eureka mine in Utah will not hereafter be entirely dependent on the Utah smelter. Some ores from Centennial-Eureka can now be shipped to the Mammoth smelter in case of necessity.

At the smelting plant in Utah many additions and experiments have been made with a view to avoiding damage to the surrounding farms by smelter smoke. On a recent showing in the United States Circuit Court as to what has been accompliished in this direction, the Court modified its decision so as to permit the operation of the lead smelter. Preparations are now being made to resume at the Utah plant the smelting of custom ores and ores from Centennial-Eureka and Bingham mines.

Experiments have been in progress on a process for neutralizing the sulphuric acid in the smoke so as to permit the passing through a bag-house of all the smoke from the various smelting operations. The company's research chemist, C. B. Sprague, developed a process that has made this operation practical.

From the Bingham properties 97,321 tons were extracted during the year; 194,016 tons was shipped from the Centennial Eureka, and the Mammoth mines produced 201,123. The total amount of charge handled during the year was 659,306 tons. The company has been increasing plant and extending the scope of its operations widely and rapidly. The new plant includes the copper smelter at Chrome, equipment for the Richmond-Eureka mine, and the Loreto and Guerrero mills at Pachuca. As a shareholder it is also interested in the new smelter of the Peruvian Mining & Smelting Co. The United States Mining Co. owns either the whole or a majority of the stocks of the United States Smelting Co., Centennial-Eureka Mining Co., Mammoth Copper Mining Co., United States Stores Co., United States Lime Co., United States Metals Refining Co. It also owns one-half of the stock of the International Metals Selling Co. and a majority of the stock and bonds of the Niagara Mining & Smelting Co. It owns all the preferred stock and a majority of the common stock of the American Exploration Co., and has acquired during the year additional holdings in the Richmond-Eureka Mining Co. In addition to the nine-tenths of the stock of the Real del Monte Mining Co. already owned, the company acquired during the year all the remaining capital stock of that company, namely, 15,984 shares, which were received in exchange for an equal number of shares of preferred stock of the United States Smelting, Refining & Mining Co. Through this ownership it becomes the holder of over 99% of the stock of the Compañia de Real del Monte y Pachuca, in Mexico. The total number of preferred stockholders is 5104, and of common stockholders 1405 at this date. There are outstanding 6% debentures of the United States Mining Co., maturing in 1909, amounting to $500,000.

RAND MINES, LTD., TRANSVAAL.

The report of the directors of the Rand Mines, Ltd., for the year 1907, at the thirteenth annual meeting in London, presents the following statement of accounts:

Cash and cash assets on hand, end of 1906		£757,244 6 2
Net profit earned for year under review		675,082 8 0
Total		£1,432,326 14 2
Which has been dealt with as follows:		
Investment accounts—		
Net increase for year	£50,293 16 6	
Debentures repaid or purchased	121,150 0 0	
		£171,443 16 6
Dividends No. 8 and 9		583,685 14 0
Balance, cash and cash assets on hand, after allowing for all liabilities excepting debentures		677,197 3 8
		£1,432,326 14 2

The profit and loss account gives full details of the profit for the year. The amount received for dividends on shareholdings again shows a substantial increase for the year, being £87,404 7s. 3d. more than for the year 1906. The more important changes in investments during the year consist in the purchase of 15,283 £1 shares in the Durban Roodepoort Deep, Ltd.; 8200 £1 shares in the Paarl Central G. M. & Exploration Co., Ltd.; 5875 £1 shares of the Simmer & Jack West, Ltd., were exchanged for 7050 £1 shares of the Jupiter G. M. Co., Ltd., on the amalgamation of those companies. Sundry miscellaneous shares were acquired, at a cost of £38,358, and 4338 £1 shares of the Robinson Central Deep, Ltd., were sold.

During the past year the company took advantage of its rights under the debenture conditions to purchase £37,800 of the outstanding debentures, which have been cancelled, together with the £83,350 redeemed at the commencement of last year. The total reduction in the issue for the year

is thus seen to have been £121,150, and the balance outstanding on December 31 was £378,850. A further annual installment of £83,350 was drawn on December 3, 1907, for redemption on January 1, 1908. Dividends amounting to 130%, or 6s. 6d. per share, have been paid during the year. The amount distributed was £583,685 14s. It will be seen that the amount paid in dividends aggregates £3,239,735 12s.

The general manager's report contains full particulars of the operations of the Subsidiary Companies and information respecting other companies in which the Rand Mines, Ltd., holds an interest. The Subsidiary Companies show increased working profits over the previous year amounting to £375,115 4s. 4d. The crushing duty per stamp has been increased to an average of 6.181 tons per day, and the average working costs show a reduction of 1s. 3.625d. per ton. This satisfactory result has been accomplished chiefly by the tube-mill installations which have been in full operation during the year. It should be noted that the average actual extraction was 94.858% for the year, as compared with 93.858% for the year 1906, while the average value of residues has fallen to 0.461 dwt. per ton, as against 0.531 dwt. per ton for the previous year.

In May last a strike took place among the miners of the Witwatersrand, and most of the Subsidiary Companies of the group were affected. The strenuous efforts made by the managers and the loyal co-operation of their staffs enabled the companies to carry on operations without interruption, though on a slightly curtailed basis. But for this the results of the year would have shown an even greater improvement. Three of the Subsidiary Companies have in hand additions to their plants—the Nourse Mines, Ltd., proposes to add two tube-mills to its 80-stamp mill, together with additional cyanide plant for the treatment of accumulated slimes: the Ferreira Deep, Ltd., has erected and shortly will be running a further 40 stamps, making in all 160 stamps, together with tube-mills and other plant; the Durban Roodepoort Deep, Ltd., in view of the encouraging developments from its new shaft, has decided to erect a further 40 stamps and additional cyanide plant, which will be running toward the end of the year. The Langlaagte Deep, Ltd., will shortly pay its first dividend, and may be expected to contribute regularly toward the company's income. All the producing Subsidiary Companies of the group, with the exception of the Durban Roodepoort Deep, Ltd., are thus paying dividends. As regards the last-named company, it is expected to enter the dividend-paying stage by the end of 1909. The repatriation of a number of Chinese coolies employed by various Subsidiary Companies has proceeded during the year, and will continue during the next two years as the contracts of service of the laborers expire. The replacing of these laborers by natives has received close attention, and thus far an adequate supply of native laborers has been obtained; it is, however, impossible at the present time to state definitely whether the efforts being made will be successful in permanently replacing the 13,500 Chinese laborers imported by the mines of the group. Assuming an adequate supply of native labor to be obtained, it is anticipated that the Subsidiary Companies of the group will show enhanced profits during the year 1908. Owing to the exhaustion of working capital, the South Nourse, Ltd., was compelled to discontinue its development operations at the close of the year.

COMMERCIAL PARAGRAPHS.

THE AMERICAN SPIRAL PIPE WORKS have moved their New York office to the Hudson Terminal Bdg., 50 Church street. Mr. F. B. Sanborn is in charge.

THE FORT WAYNE ELECTRIC WORKS, Fort Wayne, Indiana, have issued 'Instruction Book' No. 3032, describing their alternating current series arc-lighting system.

THE BRODERICK & BASCOM ROPE CO., St. Louis, has issued a handsomely printed and illustrated pamphlet which they have named the 'Underground Haulage Catalogue.' It describes their system of wire rope haulage and gives some comparative costs for mule and wire-rope haulage. The catalogue will be sent, free of charge, to any address.

Decisions Relating to Mining.

Specially reported for the MINING AND SCIENTIFIC PRESS.

DEED FOR MINING CLAIM—FAILING TO CONVEY EXTRA-LATERAL RIGHT.

A patent for the Massachusetts Hill Quartz Mine described certain surface ground containing about 50 acres as designated in the official survey; also a certain number of lineal feet of said mine, vein, ledge, or deposit for the length hereinbefore described throughout its entire depth, although it might enter the land adjoining; also other veins throughout their entire depths, the tops or apexes of which lay within the exterior lines of said survey within the end lines. The Massachusetts Hill Quartz Mine was a consolidation of several smaller claims; one was known as the 'Ford & Reilly' and another as the 'Stockbridge.' Thereafter the patentee conveyed to other parties a part of said mine described by the deed thus: "To that portion of said mining claim which lies east of the west bank of Wolf creek and west of the east line of said survey, being all that portion of said ground and mining claim embraced within said patent, and the survey upon which the same is founded, which lies outside of or easterly from, that part of said Massachusetts Hill mine, known as the Ford & Reilly location," etc. The deed also provided that it embraced only that portion of said mine, as surveyed and included in said patent, which was included in the Ford & Reilly survey, outside of and easterly from the actual lines and boundaries of the Ford & Reilly square location, and should not include any portion of said Massachusetts Hill mine, which was heretofore known as the 'Stockbridge Location.' The deed also conveyed all title, interest, mining right, property, and possession in or to said premises. The land actually conveyed was a small strip of less than one acre out of the original claim. In a subsequent action brought by the owner of the strip of ground so conveyed by said deed against the then owner of such Massachusetts Hill mine for the value of gold-bearing rock taken by the defendant, beneath and within the surface limits of the tract so conveyed by said deed, it was held that the defendant had no right to work the Massachusetts Hill vein where it lay beneath the surface of the land so conveyed to the plaintiff; that by the peculiar wording of the deed the grantor of the remaining tract had no right to follow the vein where it extended beneath the surface of the land conveyed; in other words, the original grantor and his successors in interest were estopped from subsequently claiming extra-lateral rights to a vein the apex of which was within his surface description.

Riley *v.* North Star Mining Co., (Cal.) 93 Pac., Dec., '07.

LOCATION OF MINE—NOTICE.

The United States Statutes providing that location of mining claims shall be distinctly marked on the ground, so that the boundaries can be readily traced, and the location notice filed, and shall contain a description of the property by which it can be identified, was held to be mandatory, and must be complied with in order to secure a valid location.

Ware *v.* White, (Ark.) 108 Southwest. 831, Jan., '08.

REMOVAL OF MINERALS—INJURY TO SURFACE—MEASURE OF DAMAGES.

Where the surface soil is injured by the removal of mineral without leaving the proper support, the damages must be based on the injury to the surface and improvements caused by such mining; and that such damages would be the difference between the value of the land immediately before the commencement of the mining, and such value immediately after the mineral was removed; and that in determining such difference the damage to improvements might also be considered.

Collins *v.* Gleason Coal Co., (Iowa) 115 Northwest. 497, March, '08.

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Editorial.

IMPROVEMENT of trails in Alaska is work well worthy of commendation. The Alaska Road Commission is to improve the main winter trail from Valdez into the interior and to construct new roads to mining camps in need of such links with the outer world. Many mining districts would gain more from good roads open to general traffic than from a single railroad controlling transportation at the sweet will of one corporation.

DURING the seven months since the October panic froze the frothy current of business, the tide of immigration has been less strong than the outward flow of population. Official records show that 467,000 work-people have left our shores, as against 337,000 entering the country, so that there has been a loss of 130,000. Even of the 337,000 no less than 117,000 came in November, before the effect of the panic was fully felt in Europe. A similar result followed the panic of 1893, although immigration was never before less than emigration.

A CRITIC reminds us that the Tennessee Coal & Iron Company, to which we referred last week, is merged into the United States Steel Corporation. This fact does not affect the point of our argument, which is that the placing of a certain order for rails only remotely affecting the general public, was proclaimed by the press as an example of financial patriotism, so to speak. The gist of it is that some money-interests, no matter which, sought to mislead the public and to manufacture sentiment. Sound business can not be built on so tenuous a commodity. Commerce is exchange of goods, not trading in hope and faith, although faith and hope are most useful in their way. The extent of the purpose to deceive appears with conclusiveness from the circumstance, of which our critic informs us, that the order of the Illinois Central Railroad for $1,456,000 worth of steel rails was actually placed last November. That looks as if the rails were seriously needed, and eliminates magnanimity and altruism as motives in any degree for the action of the railroad. The dispatches were intended to create a false impression; the effort was to manufacture good times, and the factory seems to have been situated on Wall Street.

ON ANOTHER page we take pleasure in publishing nearly the whole of a paper by Mr. Thomas H. Leggett, recently read before the American Institute of Mining Engineers. Mr. Leggett gives a most interesting summary of recent progress in the mining industry of the Transvaal. Incidentally he refers to remarks made by "one of the leading mining journals of the United States" in regard to over-capitalization of South African mines. Our ineradicable

modesty would prevent us from supposing that Mr. Leggett was referring to this journal, were it not for the fact that our pages were devoted to a discussion of this subject not long ago. He suggests very properly that the stock-market rating of shares is not the same as the nominal capitalization at the time of company organization and that this fact may have led to a confusion of ideas. But there really has been less confusion than might be supposed, for the public bought the shares on the market at three or four times their par value and so became the victims of over-capitalization. In many cases the stock was issued at a premium of 100 per cent or more, that is, £1 shares were offered to the public at £2 or more, so that any reference to the nominal capital is likely to be deceptive. The Ferreira may pay 300 per cent dividends in one year, but as the £1 shares sold at £25 in 1905 the dividend of £3 represents only 12 per cent; as the life of this mine is estimated at 5 years, 12 per cent is a wholly inadequate return from the investor's standpoint. As a matter of fact, while the financiers and promoters went in on the ground floor and obtained the shares at a price that ensured a safe and most attractive investment, the shares of the principal mines were offered to the public at a premium so large and were then boosted to a price so high that the majority of investors found themselves unlucky speculators, that is, they bought for the sake of the regular interest on the money they put into Rand shares and, though many of them lived to see the prices kited, they did not sell but held to their stock only to find in the end that they had an investment which, after making allowance for redemption of capital, gave them 3 or 4 per cent, plus anxiety. For this over-estimation the better class of mining engineers were not responsible, and when retained by investors they gave them sound advice, which was often set aside in favor of more optimistic and less responsible counsellors.

WHETHER Mr. Hammond will be elected Vice-President, whether, indeed, he will even be nominated, is a matter outside the scope of our comment, for this journal can have nothing to do with party politics. But the incident will prove interesting to many members of the profession in which Mr. Hammond was trained, and it prompts one or two observations. In the first place, the idea of a man without experience in politics or legislation, though unusually capable as a financial diplomat, becoming the presiding officer of the United States Senate and a possible successor to the President in case of a fatality, will seem strange to a European. And yet such is the marvellous adaptability of the American character that men with less preparation have filled these offices with credit to themselves and to the country. But to us the most interesting feature is the practical assertion that a successful mining engineer is fit for any post, however high and however responsible. We like that. Time was when the mining engineer, especially in England, was regarded as a nondescript adventurer with a penchant for mineralogy: even now he yields social precedence to the Army, the Navy, and the Reserve Forces, to the Church, to the landowners, and what not besides. In France, it is true, the graduate from the École des Mines has an assured position, only second to his friends in the Army, but that is due to the fact that the École des Mines is recruited largely from well-born families. The profession itself has no special status. In America, it is altogether different. A mining engineer, like any other educated, efficient, and respectable man, need yield precedence to no one—save his wife. By reason of that equality of opportunity which is at once the glory and the strength of the American ideal, a mining engineer or any other professional man in good standing is eligible for any office from Deputy Mineral Surveyor to President of the United States. It is the emphasis placed on this fact that makes Mr. Hammond's candidacy of particular interest. As a demonstration of the democratic character of American institutions, it is worth a good deal. And why not? Doctors have proved fairly good Brigadier Generals, editors have commanded regiments creditably, publishers have proved that diplomats can be made at least as quickly as they are born, and lawyers unnumbered have taken the cares of empire without the smallest hesitation. What is the matter with the mining engineer? He's all right.

Railroad Control.

MOST of the people on the Pacific Coast will have heard with regret that Mr. George Gould has made a deal with Mr. E. H. Harriman whereby the Western Pacific railroad is to be operated under a gentleman's agreement obviating excessive competition, or, in plain English, a practical conspiracy to maintain excessive rates. Gould seems to have burned his fingers in some other railroad enterprises in the East and finding him in financial straits, Harriman has sand-bagged him into a receptive mood. Thus another hope of getting out of the grip of the Southern Pacific railroad is shattered; California, Nevada, and Arizona remain under the industrial domination of Harriman, a gentleman-pirate. We are aware that Gould offered Western Pacific bonds for sale on this Coast and apparently obtained scant support; which was a great pity. Unification should make for better and cheaper transportation facilities. We know that in effect the dominance of the one-man power has not given advantage in either quality or cost of service to the public, while it has given an enormous stimulus to stock-gambling. The two portions of the country where the railroad systems are under monopolistic control are precisely those where the rates are highest. In the New England States, where the New York, New Haven & Hartford interests dominate all lines from Hudson river points eastward, together with their network of feeders, the average freight rate per ton mile is 1.20 cent, which is the highest average rate existing in any group of States in the Union. Next to New England stands the Pacific Coast group with a rate of 1.13 cent per ton mile. It may look as if the Southern Pacific system were the more merciful of the two, but in fact the greater average length of haul runs up the average receipt per ton to $2.337, while the toll

taken in New England, where the population is large and the local short-haul freight movement is relatively large, amounts to $1.047 per ton. The Middle States possess the largest mileage of railroads unconsolidated with the great monopolistic systems, and exactly in that territory do the lowest rates obtain, being 0.65 cent per ton mile, or 71.8 cents per ton of goods moved. These figures are eloquent. The people of New England failed to sustain the New York & New England and the Boston & Albany as independent systems, and they are now paying the penalty. The people of the Pacific Coast likewise failed to sustain the Santa Fé system, and now they fail to sustain the Western Pacific. Supineness is a characteristic of democracies up to a certain point. It invites the over-reaching of powerful interests in an effort to absorb the earnings of the people. This has gone on in America until apparently we are drifting to a condition of railroad control under which three or four unscrupulous men will pull the strings for all the mail lines of transport, and the only consolation is that when they finally do win a complete control, they will lose it; for the American people will then have their eyes opened and will insist on Government management of the monopoly.

Technical Education.

IN OUR last issue we published a letter from Mr. Thomas T. Read, now professor of mining in the Imperial University of Tientsin. He discusses the education of mining engineers. It is well to ventilate the subject occasionally. Last year we ventured to suggest that each chair of mining and metallurgy should have two professors, one of whom would be lecturing while the other was gathering ammunition and inspiration in the field, that is, acquiring the first-hand knowledge without which lectures tend to become a hollow mockery. Not that we depreciate theory in order to extol what is called practical knowledge; that were to play to an ignorant gallery, for effective education must include both the study of theory and the study of practice, so that the one may be properly understood and the other intelligently applied. A teacher must have experience, and that experience, in mining or metallurgy, for example, he can get either by professional work or by close association with those doing such work. He must leave the lecture-room and go into the mine and mill. He must get alongside facts.

Discussion on this, or any other, subject is futile unless we can agree in defining the terms we use. The word 'education' expresses the divergent ideals of different people. As the dictionary defines it, education is the systematic development and cultivation of the mind, it means the drawing out of the best that is in a man and the directing of his intellectual powers to useful purposes. But here many of us part company, for what are 'useful purposes'? Shall it be our aim to turn out a highly specialized money-making human mechanism, able to earn a salary and gain great wealth at an early age? It is fair to say that some such description would fit the beau ideal of many a school of mines today. Even those who are not devoted to a crass materialism will state with the air of a great discovery that the ideal education is the one that gives the student the training best fitted to his individual development. Another idea is that the cultivation of the student's mental powers should be such as to conduce to his maximum happiness in the scheme of creation wherein he finds himself placed by no choice of his own. And it may be argued that happiness is not won by technical knowledge nor by the financial reward accruing therefrom, although knowledge and money are largely contributory to human happiness. But what is 'happiness'? Unfortunately most men only find out what is most worth having in life when life itself is near its close; a large majority chase rainbows, others stretch eager hands for Dead Sea apples that when caught are as sawdust in the mouth; not many see the fruition of their labors before the sun sets.

The engineer does not get as much out of life as he ought, because his education is faulty. He must be something of a philosopher or he remains a good deal of a fool. Man does not live by bread alone. To bring up a young fellow with the idea that the large salaries paid by the big corporations represent the laurel wreath of honorable effort is to incite children looking for food to an eager search for pebbles. The lack of money and the excess of it are alike destructive of the best that is in man; our hope should be to train a youth so that he can gain a livelihood, without looking to money as the sole purpose of his education, which should in the main be directed toward fitting him for his duties as a progressive member of the community. The man must not be sacrificed to the specialist. Engineers do not play the important part as citizens that they should, considering the effort to give them a special training, their contact with facts, their control of natural resources, their leadership in modern industry. Engineering education is not fruitful; there is too much ploughing of infertile sands; the furrow remains barren. We get assayers instead of scholars; we get samplers instead of thinkers. The old cry of unpractical dreamers being graduated from the technical colleges is no longer true; we now get uncultured and unhappy job-chasers.

Is it worth while, either from the standpoint of the individual or of the community? After all, it is the community that supports the educational establishments, whether it be directly by State endowment or by personal benefactions, and the community has a right to ask for a product conducive to enlightened progress. The individual may want to be trained as an efficient money-maker and he is entitled to receive the equipment necessary to give him a chance in the competition of life, but after that has been accorded it is well that those in authority should insist on a preparation which while conducing to his own future happiness shall also contribute to his usefulness as a citizen. The best product of any university today is a good citizen, that is, a man able and willing to do his duty as a unit in the Home, the City, the State, and the Nation. Any man able so to do is adapted to his environment and is fitted to live happily in this struggle for existence.

Personal.

W. H. Weed is at Nelson, B. C.

Bradford H. Locke is at Los Angeles.

F. L. Bosqui has returned from Goldfield.

Donald F. Campbell is on his way to London.

R. C. Shaw has returned to San José, in Costa Rica.

Robert T. Hill is expected in San Francisco shortly.

Grant H. Smith of Salt Lake is on a visit to this city.

R. H. Channing is in New York, from Cerro de Pasco.

W. J. Scrutton has returned to London from Venezuela.

F. L. Morris has gone to Hermosillo, in Sonora, Mexico.

W. H. Linney, of Spokane, was in San Francisco this week.

S. H. Pitkin, of the Wellman-Seaver-Morgan Co., is at Denver.

Robert Schorr has returned to San Francisco from Europe.

James Hoatson has returned to Calumet, Michigan, from Europe.

Frank H. Probert is examining mines near Patagonia, in Arizona.

R. Gilman Brown has returned to London from South America.

R. H. Toll is examining mines in Clear Creek county, Colorado.

S. F. Emmons will spend the mid-summer at Ems, in Germany.

H. DeC. Richards has returned to San Francisco from New York.

B. Dunstan has been appointed Government Geologist in Queensland.

John Hays Hammond is a candidate for Vice-president of the United States.

Edgar A. Collins will sail from Liverpool, on June 17, returning to Tonopah.

B. L. Thane is superintendent of the Eagle River mines, near Amalga, in Alaska.

W. A. Scott, representing the Mining and Scientific Press, is at Goldfield, Nevada.

H. E. West has returned to England from Siberia. He is now at Torquay, in Devonshire.

H. Kenyon Burch is mechanical engineer to the Moctezuma Copper Co., at Nacozari, Mexico.

William G. Devereux, of W. B. Devereux & Sons, New York, is here, on his return from Nevada.

David Goodale is manager for the Compañia Minera Rio Tinto Mexicano, at Tanazas, in Chihuahua.

Scott Turner will accompany T. A. Rickard on his journey to the principal mining regions of Alaska.

Alexander Sharp, manager of the First Thought mine, in Washington, has gone on a visit to Scotland.

John A. Reid postponed his departure from Triunfo, Lower California, but will sail by the *Curaçao* on June 6.

Frank Robbins has moved his office from the Citizens National Bank Bdg. to the Union Trust Bdg., at Los Angeles.

P. R. Whitman has left Concheño to become cyanide superintendent with the Indé Gold Mining Co., in Durango, Mexico.

Ernest A. Haggott, of Los Angeles, has been examining mines in Arizona, and is now in the Alamos district of Sonora, Mexico.

Harold B. Goodrich, manager of fuel-oil properties for the Santa Fé railroad, is examining oil-lands in California on behalf of Spurr & Cox.

H. L. Hancock, general manager of the Wallaroo & Moonta copper mines, in South Australia, has been visiting the copper region of Michigan.

Latest Market Reports.

LOCAL METAL PRICES—June 11.

Antimony	12@16c	Quicksilver (flask)	$45@45.50
Casting Copper	14¼@15¼c	Spelter	6½@ 7¼c
Pig Lead	4.85@ 5.80c	Tin	31¾@33¼c

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date	Electrolytic Copper	Lead	Spelter	Silver
June 5	12.63	4.40	4.55	52⅞
" 6	12.63	4.45	4.63	53⅞
" 7	Sunday.	No market.		
" 8	12.63	4.45	4.65	52⅞
" 9	12.69	4.49	4.63	53
" 10	12.69	4.49	4.60	53⅛
" 11	12.69	4.50	4.59	53⅜

ANGLO-AMERICAN SHARES.

Cabled from London.

	June 4. £. s. d.	June 11. £. s. d.
Camp Bird	0 13 0	0 13 0
El Oro	1 4 6	1 5 0
Esperanza	1 9 0	1 10 6
Dolores	1 5 0	1 5 0
Oroville Dredging	0 11 6	0 11 0
Stratton's Independence	0 1 6	0 1 9
Tomboy	1 15 0	1 13 9

(By courtesy of W. P. Bonbright & Co., 24 Broad St., New York.)

MINING STOCK QUOTATIONS—NEW YORK.

	Closing prices. June 4.	June 11.
Amalgamated Copper	65¼	68
American Smelting & Refining Co.	73½	75⅞
Boston Copper	11½	11⅝
Butte Coalition	23¼	23
Cumberland Ely	7⅞	7¾
Dolores	7	7
El Rayo	1¾	2
Giroux	3¼	3⅜
Greene-Cananea	9⅝	10
Indiana Sonora	4½	4¼
Miami Copper	5	5¾
Micmac	3⅛	3¼
Nevada Consolidated	11⅞	11⅞
Newhouse	7	6⅝
Nipissing	7¼	7¼
Ohio Copper	2½	2½
Tennessee Copper	37⅛	37
Utah Copper	30½	3 ½
Yukon	3⅞	3⅝

(By courtesy of Trippe & Co., 25 Broad St., New York.)

SOUTHERN NEVADA STOCKS.

San Francisco, June 11.

Atlanta	$ 18	Laguna	1.00
Belmont	80	Manhattan Con	9
Columbia Mtn	15	Midway	37
Combination Fraction	48	Montana Tonopah	1.45
Daisy	88	Nevada Hills	1.95
Fairview Eagle	45	Rawhide Queen	1.60
Florence	3.17½	Sandstorm	23
Gold Bar (Bullfrog)	5	Silver Pick	15
Goldfield Con	5.55	St. Ives	28
Gold Kewanas	26	Tonopah Extension	80
Great Bend	26	Tonopah of Nevada	8.00
Jim Butler	24	Tramp Con	15
Jumbo Extension	26	West End	47

(By courtesy of W. C. Ralston, 353 Bush St.)

COPPER SHARES—BOSTON.

	Closing prices. June 11.		Closing prices June 11.
Adventure	1½	Michigan	.....
Ahmeek	70	Mohawk	62
Allouez	27	Nevada Con	11¾
Amalgamated	68	North Butte	67½
Arcadian	3¼	Old Dominion	35
Atlantic	16	Osceola	90
Bingham Con	65	Parrot	21
Boston Con	11⅝	Phœnix	.....
Butte Coalition	23	Quincy	84
Calumet & Arizona	108¾	Rhode Island	3
Calumet & Hecla	670	Santa Fe	1¼
Centennial	23	Shannon	13⅜
Con. Mercur	42	Superior & Pittsburg	12⅛
Copper Range	72	Tamarack	58
Daly-West	10¾	Trinity	13¾
Franklin	9	United Copper com	7¼
Granby	102	Utah Copper	31
Greene-Cananea, ctf	10	Victoria	5⅛
Isle Royale	19	Winona	5½
Mass	3	Wolverine	133

General Mining News.

ALASKA.

The Rampart district will be a prominent producer again this summer, and it is estimated that the winter output now on the dumps will amount to $125,000.——The hydraulic plant, which was formerly on Big Minook creek, has been moved to Hoosier creek and will be put in operation.——The steamer *Northland* recently sailed from Ketchikan with $50,000 worth of hoisting machinery, air-drills, and other machinery for the Cymru Copper Co., at North Arm, which has been shut down several months on account of the loss of all its machinery by fire.——It is reported that the smelter of the old Alaska Copper Co., at Copper Mtn., on Prince of Wales island, has been sold, and that the new owners will remodel it and install cheaper transportation of the ore from mine to smelter.

ARIZONA.

COCHISE COUNTY.

The Willie Rose property, near Paradise, which has been idle for some time, will resume operations during June. The president is in the East selling stock and has already sold enough to assure the starting.——A sheriff's order has been issued for the sale of thirteen mining claims belonging to Cochise Con. Copper Co. near Paradise. The date of the sale is June 27.

GILA COUNTY.

The Orphan Copper Co. is building two miles of wagon road to the site of the new shaft which is to be sunk starting next month, and is moving the sinking machinery out. A 6-ft. vein of iron sulphide assaying $21 in gold and 25% sulphur has been uncovered on the Contact claim, about six miles southwest of Globe.——The May output of the Old Dominion mine at Globe was nearly 3,000,000 lb., a record surpassed only once in the history of the company, in October, 1907. Five furnaces were in commission three weeks of the time, and four furnaces the remainder of the month. A large percentage of the ore smelted was from the company's own mines.

MOHAVE COUNTY.

Water has been pumped from the Nighthawk shaft and the work of examining the property will soon be commenced. The shaft is to be sunk deeper and new backs of ore will be opened.——The suit of Nellie B. Kemper against the New Comstock Mining Co. has been compromised and a settlement effected which will result in the operation of the properties again. The company is the owner of the Katherine, the Sheeptrail group, and other mines in the part of country west of Union Pass. It also owns the Pyramid 20-stamp mill, on the Colorado river.——The Idaho-Columbus mill has just completed a run on Vanderbilt ore and made a most satisfactory clean-up. There were about 200 tons of ore milled for lessees and the concentrated product is being shipped to the smelter.

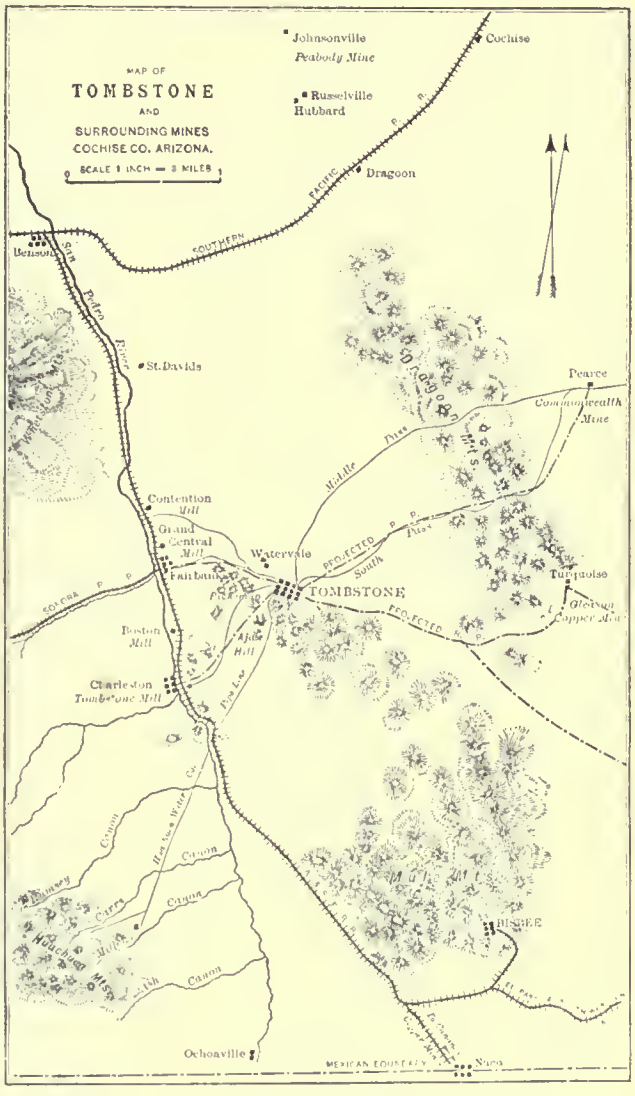
CALIFORNIA.

ELDORADO COUNTY.

The Eureka shaft, at Georgetown, will be unwatered and the shipment of ore started at an early date.——Frank Porter has bonded his mine north of Georgetown to C. G. Johnson. Development will be continued on a more extensive scale and later the working force will be increased. ——The Garden Valley Gold Mining Co. has been organized to work the Hume mine, near Georgetown, and will install machinery to work the mine. H. H. Hicks will have charge of the operations.——G. E. Lukens & Sons have incorporated the Lukens Gold Mining Co. to work their mine near Pilot Hill.

NEVADA COUNTY.

(Special Correspondence).—The 400-ft. adit at the Belle Union has cut an 18 in. vein of milling ore. A south drift is being run to develop the vein and a north drift will be started soon.——At the Union Hill extensive work is going on in the upper levels. It is reported that a new mill will be erected in the course of the next few months.——Rich gravel continues to come from the Weare property, on Banner Mtn. Local people expect to acquire the property if tests of the gravel, now under way, come up to expectations.——Several blocks of ground in the Champion mine have been leased to tributers. It is still unknown whether or not the English syndicate will exercise its option on the property.——Schlatter & Damon have resumed operations at the old Cotton Hill mine, near Washington. The 1200-ft. tunnel will be continued and developments vigorously pushed. The six-stamp mill will start as soon as enough ore has been extracted.——The Giant King mine has passed into the hands of the Western Development Co.



Southeastern Arizona.

for $35,000 in cash, stocks, and bonds. An adit is being driven to cut the main vein, which is from 50 to 100 ft. wide.——The Grey Eagle mine, at Washington, has been sold to the State for taxes. State and county taxes having not been paid for the past five years. Operations will still continue at the property.——Preliminary preparations for the starting of work on the big tunnel of the Nevada County Deep Drainage & Development Co. are under way. The road from the main thoroughfare to the tunnel site has been graded. George W. Downey will direct the work. ——The shaft at the Ethel mine has been unwatered and some good ore is exposed. Active operations will soon be resumed.——Work has commenced on the adit of the Selma mine. Development will be pushed vigorously.

Grass Valley, June 8.

PLACER COUNTY.

The Pioneer mine, near Damascus, has been leased to

H. T. Power.——The Pedlar, near Towle, has been leased to Willis Abbott and others. The dump is being treated at the Southern Cross mill.

SAN BERNARDINO COUNTY.

The Hart Florence Mining Co. is being incorporated to work the Florence group of claims, at Hart. The new company guarantees an expenditure of $15,000 for development purposes and expect to be working 10 men by June 20.——The first shipment from the Sloan lease on the Jumbo has been sent to the Cyrus Noble mill, at Searchlight.

SISKIYOU COUNTY.

The Ed Quigley mine, in Oro Fino, has been bonded to Fowler and others, who will start development at once. ——Filippe Bro., of Hawkinsville, have sold their mining property to a company of San Francisco men. The purchasers have let a contract for the sinking of a 100-ft. shaft.

TUOLUMNE COUNTY.

The motive power of the Soulsby mine, at Sonora, is to be changed from water to electricity.——It is reported that the Mack, near Big Oak Flat, will sink a new shaft. ——The Realization claim, on the east bank of the Tuolumne river, near Sonora, has been sold to H. M. Mitchell, of Healdsburg.——The Black Oak has started a small force of men stoping on the 300-ft. level, to which point the Cornish pump has lowered the water. Ten of the 40 stamps are crushing old ore which was left in the bins. The pumping still continues.

COLORADO.

CLEAR CREEK COUNTY.

(Special Correspondence).—A new strike is reported this week from the Sporting Times mine, Alpine Mtn. In running the drift west a streak of heavy lead ore has been exposed that is from 4 to 6 in. wide, and assays 2 oz. gold, 20 oz. silver, and 52% lead. The drift has now cut under the old shaft workings, and a raise has been started. Shipments are to be started next week.——There is general activity throughout the Atlantic and Daily districts. Prospectors and owners are daily arriving in that locality, and the present summer promises to be the best year since the discovery of that district.——The American Sisters mine, on Columbian Mtn., was sold last week to Jas. A. Mears, of New York City, representing a syndicate of capitalists. It is reported that the consideration is $200,000, and that a cash payment of $50,000 was made. The purchaser has already started work. The Headlight shaft is to be sunk 100 ft. deeper, from which point levels will be extended both east and west. S. Peacock, a mining engineer, with headquarters in Chicago, spent three weeks in making an examination of the mine, and it is upon his report that the deal was closed. This property has been operated during the last three years by the Two American Sisters M. M. P. & E. Co., during which time regular shipments have been maintained. The holdings are equipped with a 20-drill compressor and other necessary machinery, as well as a modern concentrating plant with a capacity of 25 tons daily. The electric plant, located two miles below Georgetown, was not included in the deal. ——Work has been started upon the Drummond group of claims. The winze from the adit level has been unwatered and now driving is under way. A streak of ore is exposed that is from 8 to 14 in. wide, and assays about $45 per ton in silver and lead. Shipments are promised during the present month.——It is understood that work in the driving ahead of the Vidler tunnel will be put under way inside of 30 days. The tunnel on this side of the mountain has been driven 3800 ft., while on the western side it is 700 ft. long. It will only be necessary to drive 2800 ft. before the connection is made, at which time an outlet will be furnished for the ores of the Montezuma district, Summit county. Stock is now being offered in the Argentine Central Ry. for the extension of that line to Montezuma, so it is a foregone conclusion that the road will go through the Vidler tunnel. This practically means that the holdings of the Waldorf Con. M. Co. and the Transcontinental T. & M. Co. will be consolidated in the near future. The deal has been pending for over a year, and this practically led up to the dissensions which arose between the American and British stockholders of the Transcontinental Co., forcing that company into bankruptcy. R. C. Vidler, the promoter of the enterprise, had long been desirous of building a railroad from Denver which would go through the tunnel, and to that end the Denver & Transcontinental Ry. Co. was organized, with a capitalization of $20,000,000. with the Argentine Central utilizing that route, Mr. Vidler has decided upon another line, alleging that he will save over 100 miles over the Vidler tunnel route.

Georgetown, June 6.

GARFIELD COUNTY.

The coke ovens of the Colorado Fuel & Iron Co., at Cardiff, three miles south of Glenwood Springs, have been re-opened with a force of 200 men. The Spring Gulch coal mines, which were opened about a month ago, supply the ovens, and the coke is used at the company's plant at Bessemer.

GILPIN COUNTY.

S. T. Harris, of Russell Gulch, has taken a lease and bond on the Rockford property, south of the Topeka mine, and the machinery which has been on the Forfar mine, on Pewabic Mtn., is to be moved and installed at once. The 200-ft. shaft is to be cleaned out, re-timbered, and put in working shape.——The shipments of ore from the Two Bros. for May will reach nearly 1200 tons.——The Golden Geyser M. & M. Co. is to transfer its holdings to a syndicate of Boston men. The property consists of 30 claims, on the east side of Jenny Lind gulch, and includes a millsite. It is reported that the new company will build a 15-stamp mill at once.

LAKE COUNTY.

The Douglas mortgage on the Matchless mine has been paid, and extensive developments will be started at once under a lease given to Denver mine. Some of the old machinery will be replaced and the old workings put in shape.—— It is again reported that the Little Evelyn property in Big Evans gulch is to be re-opened, with improved machinery and facilities for handling large amounts of material.—— Work has been started on the Siwatch adit, which is to develop and drain the country around Colorado gulch and West Sugar Loaf Mtn.——Progress during May on the Dinero adit amounted to 245 ft., making a total length of 2669 ft., leaving a little over 600 ft. which must be driven before the vein will be struck.

OURAY COUNTY.

The Treasury Tunnel, near Red Mountain, is to be opened as soon as the railroad is in operation.——Again the news comes that George Crawford will clear his properties in the Red Mountain district of indebtedness and start on all of them.——The San Antonio mine is among the properties which are anxiously awaiting the opening of the railroad, presumably June 15, in order that shipments may be started.——The Barstow mine at Ouray is being cleaned out preparatory to resumption.

SUMMIT COUNTY.

Work on the Wellington mill, at Breckenridge, has been started, and it is the intention of the company to push construction vigorously. Franz Cazin has charge of the construction.——The passenger trains of the Moffat road are running regularly to McCoy siding, about two miles from McCoy post-office.——The Kimberly mill, at Kokomo, on which work was abandoned last fall on account of the depression, will be completed at once.

TELLER COUNTY.

The British-American M. & D. Co., Cripple Creek, shipped 65 cars during May from their lease on the south end of the Dante property, on Bull hill.——A rich strike is reported at the 250-ft. level of the Cobb shaft on the Moon

Anchor.——The repairs to the hoist at Vindicator No. 2 have been completed, and Whitney & McMullin, the lessees, will continue the regular shipments.——The face of the drainage tunnel is now in 2484 ft. and was advanced 268 ft. during May. Work was stopped this week, caused by an accident to the compressor.

TELLURIDE COUNTY.

The Silver Chief property, on Bear creek, has been sold to a company of Pennsylvania men. J. B. Olsen, who had an option on the mine and has been operating under leases for some time, will be general manager for the new company.

IDAHO.

BLAINE COUNTY.

The Boston Idaho, on Boyle Mtn., will practically rebuild its mill and has recently purchased a large amount of new machinery. The new mill will use water-power and will have a capacity of 100 tons per 24-hr. day. The company will also construct tramways from its Lucky Boy and Sunday properties to the mill. A contract has been made with the American Metal Co. to take all the zinc ores for a period of five years, payment to be made on a sliding scale.——It is reported the Willow Creek Mining Co., near Hailey, will build a 10-stamp water-power mill.

BOISE COUNTY.

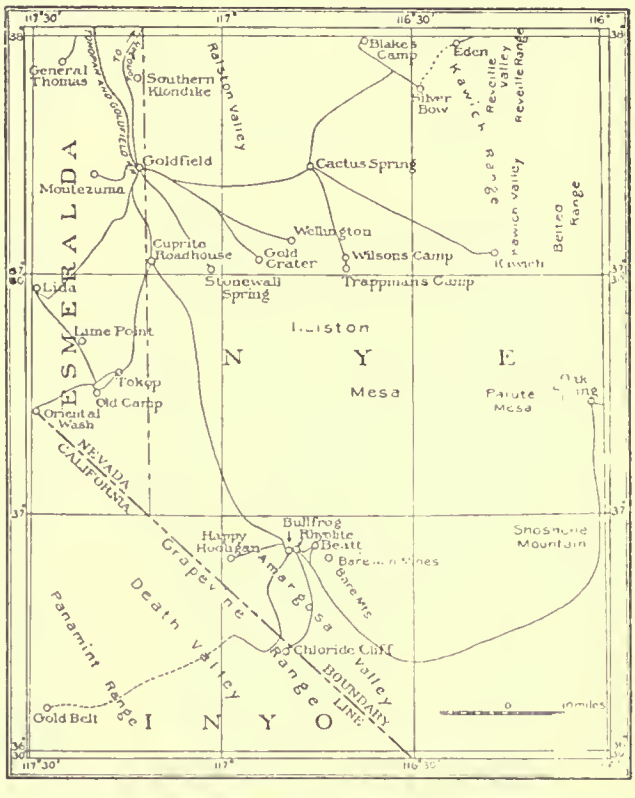
It is reported that a mill will be built at the Switzerland claim, belonging to Leo & Antone Unternahrer, in the Hay Fork district, 14 miles northeast of Idaho City. An 80-ft. head is available for water-power. A number of other mines in the same district, though not thoroughly developed, show good prospects.——A. C. Springer, of Boise, has secured an option on the Easter Sunday property, in Thomas gulch. A 300-ft. adit will be driven to strike the vein at a depth of 150 feet.

OWYHEE COUNTY.

A company has been organized to continne work on the Sunnyside group of claims, near the head of Succor creek, 12 miles from Silver City. This property made quite a production last year, at which time a small mill was constructed.——It is probable that the Banner mill, at Silver City, will be running at the time of the annual meeting of the company, June 24.

SHOSHONE COUNTY.

(Special Correspondence).—Mining activity in the Coeur d'Alene is increasing from day to day and now all the big producers, closed down during the recent depression in the metal markets, have again resumed with full forces. The Morning mine, at Mullan, resumed this week, and a force of not less than 400 men will start work as soon as they can be gathered.——Men are arriving in the district nearly every day for work in the Hecla mine at Burke. Yesterday a force of 70 men started at this property, making a total of about 170 now employed. This is the normal force, but it is the intention of the company to increase the output, and the pay-roll will be increased to about 300 men in the near future. Shipments are to begin again this week. ——The Bunker Hill & Sullivan mine, at Wardner, paid its 129th dividend today. This amounts to $75,000, and the total distributed by the company for this year is $405,000, while the grand total under the present management is $10,221,000. A full force is engaged at the mine, and it is generally expected that the monthly dividends will be materially increased in the near future.——It is expected that the Minemakers' Association will issue their blue-book of the district some time during the present month. Owing to some complications the time for receiving reports on properties has been extended until June 15. This book will contain a description of all the prospects and mines of the district, supplied by the secretary of each, and attested under oath.——The new mill at the Charles Dickens property is nearly complete and will be in operation in the next few days. The cost of the mill was in the neighborhood of $25,000, and the capacity is about 75 tons per day.——The Coeur d'Alene Investment Co., of Mullan, has made its final payment on the property of the Keystone Mining Co., in Spring gulch. The property has been under bond for $20,000 since November, 1906. Already the mine has shipped more than $200,000 worth of ore from the surface.——A body of ore valued at not less than $100,000 has been opened up in the property of the Nipsic Mining Co., at Burke, adjoining the famous Hercules mine. A raise is being driven from the third to the second level, and this has been in ore all the way, a distance of about 105 ft. It has still to be driven about 30 ft.——The Coeur d'Alene Vulcan property is now engaged in constructing a 1500-ft. flume and a 600-ft. penstock, by the use of which power will be derived for driving a Pelton water-wheel. A 3000-ft. cross-cut has been started, which will intersect three veins and tap the most southerly at a depth of about 2000 ft.——A 300-ft. shaft is to be sunk on the property of the Bullion Mining Co., near Saltese, and work will be commenced in the course of another week. This will be sunk from the No. 2 level and will give a depth of about



Part of Nevada.

500 ft. on the ore.——At a recent meeting of the directors and stockholders of the Imperial Mining Co. it was decided to increase the capital of the company from $1,000,000 to $1,500,000. The whole of the increase will be placed in the treasury, to be sold for development purposes.——An assessment of three cents a share has been declared on the capital stock of the Copper King Mining Co. The company is capitalized at $1,500,000, and the money will be used to drive a 3600-ft. adit on the property to give a depth of about 1200 ft. on the vein. The cost of this tunnel is estimated at $45,000. The assessment is payable in three instalments at intervals of six months each.——An unconfirmed report has reached Wallace to the effect that a large body of ore carrying appreciable quantities of copper and gold has been encountered in the big tunnel being run by the Chicago, Milwaukee & St. Paul railroad at Saltese. The tunnel is 1000 ft. long, and is situated on Dominion creek.——The recent strike on the property of the Cedar Creek Mining Co. has now been definitely ascertained to consist of five feet of good concentrating ore. This strike was made at a distance of about 500 ft. from the portal of the tunnel and at a depth of about 360 feet.

Wallace, June 9.

NEVADA.

ESMERALDA COUNTY.

The Quartzite Annex Mining Co. is moving the 30-hp. hoist from the Scully lease on the Sandstorm, to its property which adjoins the Jumbo Extension and the Triangle. The machinery is being erected on the Lulu No. 1 claim.——The old Junatlanta lease, which was recently forfeited, has been secured by a Milwaukee syndicate. Work will begin June 15, and the 270-ft. shaft will be deepened to 500 ft. ——During the four days allotted it by the arbitrators, the Mohawk-Combination hoisted 930 tons of ore, of an average value of $75 per ton.——The management of the St. Ives Leasing Co. has decided to sink the main shaft on the St. Ives claim 50 ft. deeper. The production of the Goldfield mines for the week ending June 5 was 2407¼ tons, valued at $188,759. The Tonopah mines produced 5758 tons, of an estimated value of a little over $100,000.

LINCOLN COUNTY.

The Searchlight-Midas Mining Co. has let a contract for sinking its 230-ft. shaft 70 ft. deeper. The property is a short distance east of Searchlight.——The California-Pioche has struck a body of rich ore in its shaft, at a depth of 180 ft. The showing is so favorable that a 40-hp. hoist has been ordered.——W. S. Anderson has ordered a gasoline engine and compressor for his mining property above Pioche.——The Ely Valley Co., operating east of Pioche, is making numerous improvements on its property, including a gasoline engine, a compressor, and several buildings.

NYE COUNTY.

It is possible that Berry & Roche may buy the plant of the Nevada Milling & Ore Purchasing Co., at Manhattan. ——The *Bullfrog Miner* gives the production of the Bullfrog mines for May as follows: Montgomery Shoshone, $86,000; Keane Wonder, $25,000; Skidoo mines, $7000; Tramp Con., $3300; Philip & Moesser Gibraltar lease, $2000; National Bank lease, $900; Original Bullfrog lease, $790; total, $124,990.——Actual construction has started on the 10-stamp custom mill of the Beatty M., M. & R. Co., at Beatty.——The only hydraulic mine on the Great American Desert is being operated by the Round Mountain Hydraulic Mining Co. They are operating three monitors, and it is claimed they are cleaning up $1000 per day.——Arrangements have been completed with the Belmont Co. by which all future operations in the North Star and Rescue will be carried on through the Belmont shaft, and work through the shafts of the former companies will be abandoned.

WHITE PINE COUNTY.

(Special Correspondence).—Renewed activity is reported from Hamilton and the adjacent district. This camp, which is 20 miles due west of Ely, is the oldest in Nevada, and produced, between the years 1868 and '73, $40,000,000 worth of silver bullion, and during that time boasted a population of 20,000 people. Since then, however, the camp has been forgotten in the mining world. A number of the properties in the district have been worked spasmodically, and have produced enough silver to furnish a livelihood for the 300 people remaining. The McEllin, 3½ miles northwest of Hamilton, is working six men and extracting $30,000 to $35,000 each season. The Nevada Lead Co., operating on a neighboring property, is a newcomer, but already has a large quantity of ore on its dump and will proceed with active mining this season. The Alta Zoanni group, near the summit of White Pine Mtn., has some high-grade silver-lead ore in sight, and also a carload on the dump which is to be shipped soon. Other promising properties are the Rocco-Homestake, the Roosevelt, and the Julia No. 2. A total shipment of 2500 tons from the Hamilton district is predicted for the coming season.

Hamilton, June 5.

It is possible that the Ely Central will sink a number of shafts on its property between the Ruth and Copper Flat groups of the Nevada Con.——The French-American Mining Co. has started work on its Duzette group, near Lane City. Samples of the ore from this property assay 27% copper, $14 gold, and 11 oz. silver.——The Veteran has been hoisting about 400 tons per day, and this output will be greatly increased within a week or ten days, when the electric hoist is put into commission.

MICHIGAN.

James L. Nankewis, Commissioner of Mineral Statistics for Michigan, has issued a resumé of the important facts in his forthcoming annual report for 1907. He reports, on a whole, a favorable outcome of the year's operations. The number of men employed in the mines was larger than that of any previous year, and several companies made record productions of copper. The average total of the men employed in three counties of Houghton, Keweenaw, and Ontonagan was 21,014. The copper production was 220,217,892 lb., being a decrease of 2% compared with 1906 and an increase of 1% over 1905. Dividends paid, including the Copper Range Co., the St. Mary's Mineral Land Co., and the Union Land Co., amounted to $15,114,700. The Copper Range, the Quincy, the Tamarack, the Mohawk, and several others, each produced more copper in 1907 than in the previous year.——The Michigan mine, at Houghton, has recently received five cars of Woodbury jigs for the mill.——The Champion has installed at the C shaft a Nordberg hoist which will enable them to sink to the 8000-ft. level. It will be in commission about July 1.

MONTANA.

Excessive fall of snow and rain during May caused severe floods throughout the State, resulting in considerable damage to property and loss of life. Several mining properties were compelled to close and suffered no small loss. The railroad between Great Falls and Helena suffered such a serious washout that it will require two months to repair the damage. During that time the smelter of the Boston & Montana will have to shut down, and consequently the Boston & Montana mines, at Butte, will also be closed, and as a result five thousand men will be thrown out of employment. A cloud-burst on Wednesday night caused a washout on the Butte, Anaconda & Pacific railway, and compelled the Amalgamated, the North Butte, and the Coalition mines to close. The break will be repaired in a day or two.

UTAH.

JUAB COUNTY.

The Iron Blossom has cut ore on the 600-ft. level.——The Tintic Silver Co. has been incorporated to exploit the Lake View and the Blue Point claims in the North Tintic district.——The Raymond-Illinois is ready to resume development, the water which accumulated during the repairs having been removed.——The shipments from the mines of Tintic for the week ending June 5 were as follows: Centennial-Eureka, 38 carloads; May Day, 4; Eureka Hill, 11; Yankee Con., 1; Bullion Beck, 2 carloads.——It is probable that the Eagle & Blue Bell mine, at Park City, will be opened within a week or ten days.——Work has been resumed in the winze of the Sioux Con. of Tintic.——Eleven cars of ore from the Silver Shield mine, at Bingham, arrived at the new Tintic smelter this week. The plant will not be ready to run, however, until July 1.

SALT LAKE COUNTY.

The Commercial mine, at Bingham Canyon, has resumed with two shifts.——The Utah Copper has installed two Chilean mills at its plant.——It is reported that the New England Gold & Copper Mining Co. will resume production after the meeting of the directors at Denver on July 15.

SUMMIT COUNTY.

It is reported that the Daly and the Naildriver properties, at Park City, will resume soon.——The official survey of the Park-Virginia property, formerly the Clark-Virginia, was completed last week and it is expected that development will be undertaken at once.

UTAH COUNTY.

Jesse Knight has purchased the controlling interest of

the Major Evans Con. M. & M. Co., whose property is in the American Fork canyon. This is the second property in the district to be taken over by the Knight interests, the Mineral Flat having been acquired last summer. The new acquisition is near the Mineral Flat.

WASHINGTON.

OKANOGAN COUNTY.

(Special Correspondence).—The Q. S. Mining Co. has all the machinery for its power plant on Sinlahekin creek, on the ground, but has delayed its installation pending the adjustment of some internal affairs of the company which will eventually lead to re-organization. The Q. S. vein has been intersected at a vertical depth of 800 ft. It assays as high as 20% copper, but the average content is 3.6%. Work in the lower adit has been suspended pending the re-organization referred to. When the Okanogan Electric Railway is completed the company expects to begin regular shipments.——The Arlington mine, in the old Ruby camp, is driving a 1000-ft. adit to strike the vein at a depth of 400 ft. There is now a shaft on the vein, from which rich argentine and native silver have been taken.——A water-right has been located on Salmon creek for the Okanogan Electric Railway.

Oroville, June 8.

STEVENS COUNTY.

(Special Correspondence).—The Gem mine, near the Trojan, in Pierre Lake district, has started active operation. ——The Napoleon mine will soon work a full force of two shifts and expect to ship from 150 to 200 tons per day to British Columbia smelter, at Greenwood, B. C.——The Deer Park Mining Co. has three men employed and it is believed they have struck rich ore, although the management is giving out no information.

Metaline, June 9.

CANADA.

BRITISH COLUMBIA.

The St. Elmo property, 11½ miles from Rossland, has been leased to John Selda and associates, for 18 months. This mine was last worked about six years ago, at which time there was a good deal of ore blocked out, which will now be shipped.——The gross output of the Le Roi mine for the month of April was nearly $90,000, which is a little more than the average.——The Pot Fraction has been leased to Hooper, Dailey & Nottinger for three years.—— The Golden Rule management has let a contract to sink its shaft 50 ft. deeper.——The lessees of the Evening Star, which has been idle for several weeks, have resumed.

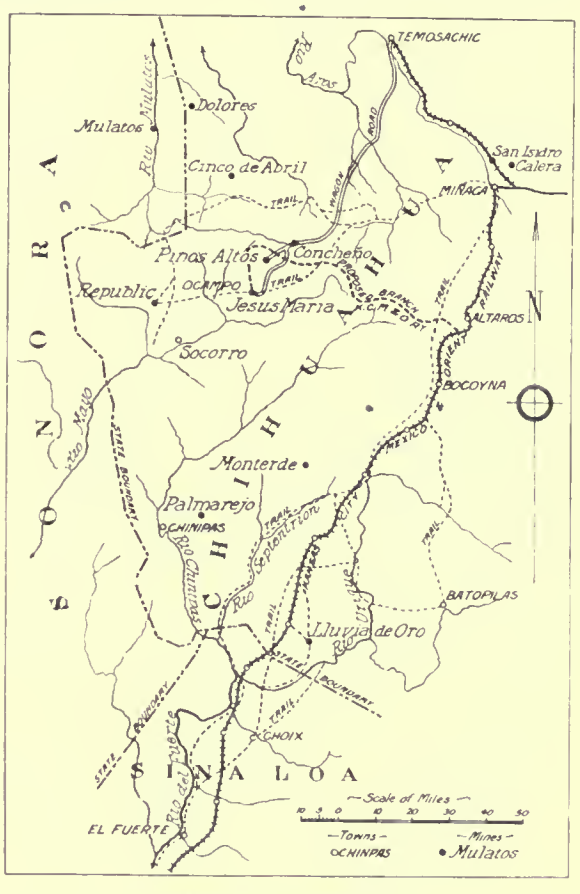
Following is the tonnage of ore shipped from and crushed at the mines of Rossland for the week ending May 30, and for the year to date:

Mine.	Week.	Year.
Centre Star	2,956	73,111
Le Roi	1,890	35,739
Josie	315	11,534
California-Giant	....	95
Blue Bird	....	110
Red Eagle	....	20
Evening Star	....	128
Totals	5,161	121,037

At the smelter of the Consolidated Co., at Trail, there was received during the past week 5291 tons of ore. Besides that shipped from Rossland, other mines sent in ore as follows: Ymir, 21 tons; Hewitt, 22; Richmond-Eureka, 48; Snowstorm, 776; First Thought, 138; St. Eugene, 212; Giant, 18; Silver Cup, 39; True Fissure, 53 tons.

MEXICO.

The Benito Juarez Mines Co. is receiving the machinery for its 150-ton mill and cyanide plant at Peñon Blanco, S. L. P. The plant will consist of a battery of twenty 1050-lb. stamps, dropping in deep mortars of the El Oro type; a No. 4 Gates crusher, a 16-ft. wet grinding tube mill, and a Dorr classifier. There will be 23 steel cyanide tanks for sand and slime treatment, and a complete precipitating and refining outfit. Both the mill and the several mines of the company will be operated by electric power. The company has suspended ore shipments and is storing its ore pending the completion of the mill.——A new company has been organized to take over the Guadalupe mine in the Ejutla district of Oaxaca. The shaft is 285 ft. deep and will be sunk to the 400-ft. level and a drift run at the 300.——The Los Arcos M. & S. Co. has temporarily closed its smelter and is making preparations for the erection of a 100-ton concentrating and cyanide plant at its mines in the Sultepec district.——Grading has been commenced for the new 5-stamp mill of the Chicago-Mexican Mining Co., near Cusihuiriachic, Chih.——A 30-ton reduction plant, consisting of stamps, concentrating tables, and a cyanide annex, will be erected on the El Tajo mine of the El Tajo Mining Co., at San Sebastian, Jalisco. It is estimated that the milling ore now available is sufficient to keep the mill busy for several years.——In the new stamp-mill of the Mexican Mining Co. at La Luz, Gto., the mill will be operated without cams, the stamps being worked by a line shaft and eccentrics instead of with a cam arm and shaft. The stamps will fall 200 times per minute by the new process. The mill capacity will be 50 tons.——The Santa Lucia mine, at Balsas, Gro., will be operated on an extensive scale this summer. Three miles of railroad will be built to connect with the Mexican Central and a 150-ton smelter installed. ——The Sierra Madre y Pacifico railroad, now operating from Ciudad Juarez to Casas Grandes, Chih., will be extended probably this year to Madera, Chih., the seat of W. C. Greene's lumber operations.——The San Carlos copper mines, San Jose, Tamps., are expected to resume operations some time this month. The property is owned by the Nichols Chemical Co., of New York, and is equipped with smelter and reached by a branch line of railroad. The deposit is extensive but low-grade, yielding mostly copper. ——The Grenadeña Mining Co., Santa Barbara, Chih., will build an aereal tramway 5 km. long from its mines to its mill. It will have a capacity of 10 tons per hour. It is reported that the mill will be started up again within the next month. Sewell Truax is manager.



Map of Part of Mexico.

Special Correspondence.

LONDON.

Wild-Cat Booming of Russian Mines.—Tanganyika Concessions.—Mt. Lyell Report.

Between two and three years ago a great deal was heard in London about the wonderful properties in Russia acquired by the Siberian Proprietary Mines, Ltd., otherwise Mr. Hyman Orkin. Gold deposits of great value had been leased in the Kotchkar district of Orenburg, and copper and coal properties in the Pavlodar district of Semipalatinsk. The capital of the company was originally £100,000, of which £65,000 was issued fully paid as purchase price, and the remainder was subscribed at an average premium of 100%. Just a year ago 16,000 new shares were issued at £12 10s. each, that is, at a premium of 1150%, a fact which indicates pretty fairly the nature of the boom. Two subsidiary companies have been formed to acquire gold mines in Orenburg, one the Orsk Goldfields, Ltd., and the other the Troitzk Goldfields, Ltd. The issued share capital of both of these is £500,000, of which £251,000 in each case is retained by the parent company. When the two subsidiary companies were promoted, the whole of the share capital was allotted to the parent company, credited with about two-thirds paid up on each share. The idea was that the remainder of the liability on each share would be paid up by the parent company and would form the working capital. It will be seen, however, by examining the accounts, that enough of the shares were sold in the open market at high premiums to pay off the liability on the remaining shares, to provide working capital, and to give a certain amount of profit in other directions. In the midst of this boom there were not wanting skeptics, and those who knew the properties personally uttered warnings. At least one of the independent mining papers had something to say about it. Later on, the promoters were forced to set their house in order, and Messrs. Hooper & Speak were appointed consulting engineers. This firm soon found out that the prospects were quite commonplace affairs, instead of bonanzas. The properties belonging to the Orsk company have been turned down, but as the lease does not expire for nine months a little exploratory work is still being done. The Troitzk company's property is doing better, for the deposit, though of low grade, is fairly extensive, and it is intended to erect new plant to treat 5000 tons per month. The Pavlodar coal and copper properties have not yielded much so far, and the consulting engineers recommend that exploration work with the diamond drill shall be done on the copper properties. Owing to the method of financing the subsidiaries, the Siberian Proprietary still has the bulk of its capital intact, and has over £180,000 cash in the bank. There have been a good many re-arrangements in the constitution of the directorate. Edward Hooper has joined the board and Mr. Orkin has relinquished his special powers and emoluments. Under the new régime it is more than probable that the company will after all attain an honorable position.

The copper deposits in the central parts of Africa are now exciting increased interest in London, and Mr. Farrell's article in your issue of April 18 on the Tanganyika Concession's properties was specially welcome at the present juncture. There are several other copper deposits of great promise in Africa, but very little has been published relating to them. One of the most important of these is the Bwana M'Kubwa, which is situated about 150 miles to the southeast of the Kansanshi. This property belongs to the Rhodesia Copper Co., which is one of the subsidiaries of the Northern Copper (B. S. A.) Co. Owing to the difficulties of communication and transport, progress at the mine has not been rapid, and much care has been taken not to rush things. The vein has now been proved by three shafts and two levels over a distance of 1300 ft. to a depth of 250 ft. The average width of the deposit is 4 ft., and it is estimated that there is about 80,000 tons of ore in this block averaging 15% copper, in addition to some 20,000 tons of ore running from 4 to 10%. The ore thus far found is the carbonate of copper in a silicious gangue. On each side of the vein the sandstone is impregnated with carbonate of copper for something like 40 ft., and the copper contents are as high as 4 to 5%. There is something like 1,200,000 tons of this class of ore so far developed. At two points the workings have been carried a hundred feet lower, and as far as the development has gone, the ore continues to be of the same character. The question of the most suitable method of treating the ore is engaging the anxious attention of metallurgists, who are studying the sources of supply of fuels and fluxes. The Northern Territories Co. also has a large interest in the Kafue Copper Development Co., which operates the Sable Antelope mine in the same district. This mine contains a variety of sulphides, and it has been sufficiently developed to the 300-ft. level to warrant the erection of a 25-ton smelter. There are also two other properties that are coming forward well, one, the Messina in the Northern Transvaal, and the other the Edmundian, in Portuguese territory, between Beira and

Salisbury. But of these two I will write on another occasion.

In December last I referred to the confusing method adopted by the Mount Lyell Co. in publishing the results for the half-year ended September 30, 1907. Owing to the slump in copper during that period, the prices at which the metal was sold varied greatly, and in addition a large part of the production was not sold at all. The report issued by the company did not make the situation clear, and there was in consequence much uncertainty as to the position of the company. The report for the half-year ended March 31 last contains no vagueness of this sort, and states the results of the work more explicitly. During the six months the production at the smelter was 4301 tons of blister copper, which is estimated to contain 4201 tons of fine copper, 10,489 oz. gold, and 344,608 oz. silver. At the beginning of the period, October 1, 1907, the unsold copper on hand was 2389 tons, which has since been sold at an average price of £61. Of the last half-year's production, 3311 tons were sold at an average price of £61 8s., leaving 908 tons unsold at the end of the half-year. The net profit for the half-year was £128,980, of which £105,000 has been distributed as dividend, which is at the rate of 1s. 9d. per £1 share, or 17½% per annum.

The amount of ore treated during the half-year was 202,014 tons, averaging 2.46% copper, 1.77 oz. silver, and just under 1 dwt. gold. Of this, 139,370 tons came from the Mount Lyell and 62,644 from the North Mount Lyell. In addition, 204 tons of purchased ore and 7525 tons of metal-bearing flux were treated. The ore-reserves have been con-

siderably increased during the year, and the orebodies at the 1000-ft. level at the North Mount Lyell are opening up in a most satisfactory way. On March 31 the reserves are figured as follows: at the Mount Lyell mine, available by means of open-cut, 909,471 tons, estimated to contain 0.6% copper, 1.93 oz. silver, and 0.86 dwt. gold per ton; available by underground mining, 2,613,945 tons, estimated to contain 0.52% copper, 1.97 oz. silver, and 0.5 dwt. gold; at the North Mount Lyell, 606,658 tons, of an estimated average value of 5¾% copper, 1.33 oz. silver, and 0.1 dwt. gold. The reserves at North Mount Lyell on September 30 last were 438,020 tons, so that, allowing for 63,250 tons extracted during the period, the increase has been 231,888 tons.

TORONTO, CANADA.

La Rose Consolidated.—North American Smelting & Reduction Co.—Ore Shipments.—Ore Discoveries.—Government Experiments with Peat.—Yukon Consolidated Gold.—Lead Bounties.

What is likely to be a notable event in the history of Cobalt is the accomplishment of the merger of the La Rose mine with the University and several other properties, that had been for some time in contemplation. The new company is known as the La Rose Consolidated, and is capitalized at $6,500,000, the shares being placed at $5 each. The holdings, comprising in all 317 acres, embrace, in addition to the well known La Rose and University properties, the La Rose extension of 40 acres directly to the north, upon which the big veins of the La Rose have been traced; the Violet, adjacent to the La Rose and O'Brien; the Princess, situated near the McKinley and Silver Queen; the Fisher-Eplitt, and the Silver Hill properties. Of the capitalization $1,000,000 is reserved for the purchase of new properties. The board of directors comprises the La Rose owners, John and Duncan Martin, Henry and Noah Timmins, and David Dunlop, with the addition of David Faskin, of Toronto, and E. P. Earle, Richard T. Greene, and Frank Holmes, of New York. The smelter of the North American Smelting & Reduction Co., at Thorold, Ontario, controlled by the owners of the Coniagas mine, which has been for some time under construction, has finally been completed and put in operation with a force of about forty men. Tests of the furnaces were made on June 2, and proved completely satisfactory. Cobalt ore from the Coniagas mine has been received to the extent of several carloads and is now undergoing treatment. For the present, operations will be limited to the Conlagas output, but an extension of the plant is contemplated which will enable the smelter to receive other ore. Heavy shipments of Cobalt ore continue, the total for the week ending May 30 being 459 tons from the following mines: Coniagas, 31 tons; Drummond, 28; La Rose, 30; McKinley, 33; Nipissing, 92; O'Brien, 127; Silver Queen, 55; and Tretheway, 72 tons. An important strike was made on the Nipissing property on May 29 by a diamond drill in a vein situated between the Big Bonanza or 49 vein and the Kendall vein at the south end of Cobalt lake. The ore showed a width of 4 in., and carried 3500 oz. silver per ton. The vein is supposed to form a connecting link between vein 49 and the Kendall, which are over ¼ mile apart. Great progress is being made in development work. The eastern extension of vein 49 is being worked by open-cut. An adit is being driven in from the shore of Cobalt lake, and is now in 1000 ft., for the delivery of ore from veins 26, and eastern extension of 49, Kendall vein, and Promise vein to a concentrator to be built at the mouth. It will also serve the purpose of giving needed ventilation to the workings. The Promise vein is the continuation on the Nipissing of the Niccolite vein now under development on Cobalt Lake and a shaft is being sunk to prospect it close to the Cobalt Lake workings. A station is being cut at the 140-ft. level on the Kendall vein, from which driving will be done. A large addition to the force has been made for surface prospecting. A shaft is down 75 ft. on the property lying to the north of Cobalt town on a vein which has been identified as being the rich vein on the Tretheway. A new 250-kw. generator of 2000 volts, and a high-speed engine, have been installed to furnish power for the entire mine equipment. A car of 32½ tons of ore recently shipped from the Silver Leaf has netted $160,000, being one of the richest shipments ever made from the camp. The main shaft on this property is now down 150 ft., and the vein at the bottom of the shaft is 4 in. wide, and carries about 5000 oz. silver per ton. A rich vein was lately struck in cross-cutting at the first level on the Nancy Helen, when a 5-in. vein containing native silver in large quantities was encountered, which is believed to be an extension of Buffalo No. 4.

The Canadian Department of Mines will undertake a series of experiments with a view to utilizing the extensive peat deposits of Canada. A Swedish expert conversant with European methods has been secured, and an experimental plant will be established, probably in Ottawa, where investigations will be carried on in the methods of obtaining producer gas from peat, as well as other means of utilizing peat industrially. An examination as to the extent and quality of Canadian peat beds will also be made.

The Yukon Consolidated Gold Fields Co. has secured the services of six men from the Toronto School of Science to take charge of a portion of its hydraulic mining system about 15 miles from Dawson. The party, which has left Toronto for the Yukon includes K. A. Mackenzie, R. E. W. Hagarty, C. R. Murdock, J. A. Walker, J. E. Gray, and C. S. Cameron. These are the first Canadians engaged for engineering work by the Yukon company, which has hitherto employed graduates of American colleges for this class of work. The Canadian Minister of Finance has introduced into Parliament at Ottawa a resolution extending the bounties on lead mined in Canada for another five years, which would otherwise expire at the end of June. The conditions are made more favorable to the lead miners. The former legislation provided that the amount so paid should not exceed $500,000 in any one year. By the present resolutions the total for five years is fixed at $2,500,000, without limitation as to each separate year's payments. The amount of the bounty is the same as before, $15 per ton, but while formerly the rate was reduced when the price reached £12 10s. in England, and the bounty ceased altogether when the English price rose to £16, the new resolutions fix the point at which a reduction is to be made at a standard selling price of £14 10s., the vanishing point remaining as before.

MEXICO.

New Mining Law.—Restrictions on Foreign Companies.—Chamber of Mines.

It would seem from recent circumstances, notably as reflected in several articles of the proposed new mining law, that an anti-foreign feeling was coming to the surface even among the better class of the Mexican people. When, two years ago, an anti-foreign scare was discussed in the papers, and it was rumored that on September 16, 1906, all foreigners would be killed or driven out of the country, it was stated that such feeling as existed in the Republic was limited to the laboring classes, particularly along the railroads, and near the International border. But now objection to the foreigner seems to be manifest in the more enlightened circles; in the Congress of the Republic; and in one of the Government departments. But a few weeks ago Lic. Rosendo Piñeda, a lawyer of Mexico City and a member of Congress, proposed an amendment to the Constitution, placing restrictions upon foreigners in the practice of the professions, particularly that of the law, in the Republic of Mexico, and during the past week an absolutely prohibitory measure, aimed at foreigners, has been learned to exist in the proposed new mining law, which has been drafted at the instance of the minister of fomento, Lic. Oligario Molina. The sections referred to deny to foreigners the right to denounce or obtain mining properties in Mexico, and prohibit foreign companies from acquiring title to mining properties in the Republic. The articles embodying these prohibitions are in full as follows:

Art. 141.—No title deed for mining property can be issued

to foreigners denouncing properties within the bounds of border States, if they do not previously obtain a special permission from the executive of the Union. This requirement will also be exacted when the denouncement is made conjointly by foreigners and Mexicans. If the permission is refused, the ground shall be declared free, and the same effects result as those consequent on voluntary abandonment of a denouncement, as set forth in Article 36.

Art. 142.—The permission mentioned in the foregoing article will also be necessary in order that foreigners may through any other process come into possession of mining properties or liens thereon in any of the border States or Territories.

Art. 144.—Foreign corporate bodies are incapable of denouncing and acquiring henceforth, by any process, either mining properties or liens thereon within the territory of the Mexican Republic.

By the law of 1856 foreigners were debarred from acquiring land of any kind in a zone 20 leagues wide along the northern border without permission from the Federal Government. The new law would affect the entire area of the States of Sonora, Chihuahua, Coahuila, Nuevo Leon, Tamaulipas, and the Territory of Baja California. Some have held that the Government feared the growing strength of the foreign population in the North, but Article 144 of the law indicates that there is a deeper purpose. The adoption of this article would mean that every foreign company, to hold mining properties in this country, would have to incorporate under the laws of Mexico, thus requiring their head offices to be in Mexico, and their principal officers to be residents of the Republic. This would be a practically prohibitory measure. It would seem to be suicidal for Mexico to adopt this. Unless concessions are made to capital it will go elsewhere, and Mexico will be allowed to drop behind. The draft of the new law was submitted to the Chamber of Mines, which has just been in session in Mexico City, for study and comment, and by unanimous vote of the Mexican members it was decided to ask the Government to wholly suppress Article 144. During the discussion Lic. José L. Riqueña, one of the wealthiest residents of Mexico, president of the Dos Estrellas Mining Co. of El Oro, made a lengthy speech before the Chamber in opposition to the Article, and said in part as follows: "Article 144 prohibits foreign companies from acquiring by any means title to mines or real rights in them. If this prohibition should be adopted, the national mining industry will receive the most severe blow that could be given to its growth and prosperity. Mexico is a country of great natural resources but poor in capital. . . . If we need foreign capital, we will have to leave the management of the business and the administration of the companies in the countries of their origin. . . . There is then no reason for shutting the door in their faces, nor for putting obstacles in the way of their acquiring mining properties. They do not injure us. They aid us." It is to be hoped that such counsels as these may prevail, and that the hot-heads may not rush through a law which would weaken confidence in the Republic and check the initiation of new enterprises.

Mark R. Lamb announces having just closed a contract for a Moore filter of 250 tons capacity with the S. Rafael Co. of Pachuca. This contract probably marks the end of doubts as to the rights of the Moore Filter Co. in Mexico, as the directorate of the S. Rafael Co. is composed principally of attorneys of prominence. The manager, Edmundo Girault, is the consulting metallurgist, and J. B. Empson is thoroughly posted on the filter situation since the building of the first Moore filter in Utah.

The San Carlos Mining Co., of Sonora, is receiving estimates on a 50-ton plant, in which the Behrend system of dry concentration will be used. The El Triunfo Consolidated Mining Co. will also install a concentrating mill of 50 tons capacity at its mines near Arizpe Sonora, employing the Behrend dry system of concentration. It is planned to increase the capacity to 200 tons per day in a short time.

The Cananea Copper Co. has arranged with the Department of Fomento for free importation of fuel oil for its individual use, which has received congressional sanction.

JOPLIN, MISSOURI.

Flood-Damage at Webb City.—Center Creek Development.—New Concentrating Plants.—Miami, Oklahoma.

The heavy rains of the past few weeks have caused much damage to mines in the Missouri-Kansas district, especially in Granby, Spring City, Spurgeon, and along Spring river and Center creek. Some of the largest mines and best producers in the field are threatened along Center creek, in the sheet-ground camp north of Webb City. The danger is increased because of the closing down of the Vantage pumping plant, which for four years has kept the mines drained along the valley between Webb City and Oronogo. Some months ago the Vantage plant threatened to shut down on account of the heavy expense entailed, but the neighboring mines lent assistance by paying a certain portion of the expense, and the pumps were kept going until last week. The mines in the vicinity have been installing larger pumps and hope to control the water without the aid of the Vantage plant, which was the largest in the Missouri-Kansas district. There has been a great decrease in pumping in this region, about one-fourth of the mines having closed since last year, and this, together with the wet spring, has caused a heavy loss to the district. The output has been curtailed to an average slightly exceeding 4000 tons per week. This curtailment has had no appreciable effect upon the zinc-ore market. Instead of increasing the demand, the market is receding, and ore prices range from $32 to $35 per ton for 60% zinc. However, those mines producing galena in conjunction with zinc-blende are weathering the storm, as the price of galena has increased steadily during the past two months at the rate of $1 per week, until last week's sales were made upon a basis of $60 per ton for 80% grade.

The most important development work contemplated in Webb City is that being undertaken by the Center Creek Mining Co. in re-opening the ground between Webb City and Carterville. This territory has produced in excess of $13,000,000 worth of lead and zinc ore, which has come principally from the upper runs above the 150-ft. level. In obtaining this the ground was badly handled, little provision being made for pillars, and timbering was done merely well enough to hold out until the workers could get out of the way. As a result much of the ground caved, making it dangerous to attempt to win some of the richest orebodies. The ground has therefore remained idle or has been gophered by small prospectors for a number of years. The company has recently had a completed survey made of the tract, and compiled upon the plat all the workings of which there was any record, together with new surveys of more recent mines. The plat shows that the ground still has a large quantity of ore reserves above the 150-ft. level. Below this the tract is underlaid with sheet ore of lower grade. The upper ground is now being opened by the Corrie Cole Mining Co. upon a lease of several acres involving the old Beasley mine and the Good Shepherd ground. Two 250-ton concentrating plants are now being erected and upon each lease two shafts are being re-opened and cribbed. The company will first work out the upper runs and will later take up the work of exploiting the lower-grade sheet ore below. The Center Creek Co. by its recent activity adds 40 acres of the richest producing ground to the Webb City territory.

The first active production from the new Oklahoma camp at Miami began last week. The output from the Old Chief, New State, and the Emma Gordon was shipped, and raised the camp to the fifth place in the list of producers. The ore consists of both galena and zinc-blende, but the galena is unimportant. The zinc-blende, while of good quality, is associated with bitumen, which lowers the grade of the concentrate by causing gangue to stick to the blende particles. The result is that when ore is $35 elsewhere in the district, this ore brings from $25 to $28 per ton. However, there is compensation to the operator in the fact that the product as mined contains generally a large per cent of metal. The problem of separation is one which will yield a large reward for its successful solution.

DOUGLAS, ARIZONA.

Copper Queen Smelter.—Calumet & Arizona Plant.—Copper Giant at Mammoth.—Nacozari Concentrator.

The Copper Queen is at present operating only six of its ten furnaces, the total charge smelted per day being a little over 2000 tons. About 1500 tons of the ore in the charge comes from the company's mines in Bisbee; 125 to 150 tons of high-grade concentrates from the Phelps-Dodge properties at Nacozari; some rich silver ore from the El Tigre mines in Mexico, together with a small amount of custom ores from Arizona. The custom business, which a year ago accounted for a large percentage of the copper output, now amounts to very little. In the near future, when the new concentrator at Nacozari is in full operation, more than double the present amount of concentrates will be received from there. In the past considerable highly silicious ore was shipped from Globe for converter-lining, but the supply has greatly decreased and shipments to the 'Queen' from that district have ceased. The Clifton-Morenci district is shipping some converter-lining and a small amount of smelting ore. The only work of importance at the smelting plant is the renewing of a hood of one of the furnaces, and the re-construction of the down-take for the same furnace. The new copper casting-machine is working satisfactorily. The plant as a whole is in excellent shape.

The five furnaces of the Calumet & Arizona Co. are running to their full capacity, having smelted on an average 1450 tons daily during the month of May. This ore is entirely from the Calumet & Arizona and Superior & Pittsburg mines, at Bisbee, the C. & A. smelter doing no custom business. Much new work is being done, with large and important changes planned for the future. There are now five furnaces with a daily capacity of 300 tons each. The material is on the ground for a sixth furnace of 500 tons capacity, which will be erected in line with the others, and in order to make room for it the converters will be changed to the opposite side of the building. After the new furnace is in operation, it is planned to enlarge the old furnaces, which will be lengthened so as to have a daily capacity of 500 tons each. At present the mines of the two companies can not supply 3000 tons of good ore daily, the Oliver being the only one that could greatly increase its output. The management expects large new ore developments in the S. & P. mines, but there is not sufficient development work being done in these properties to warrant the expectation of a large increase in production.

New Power-Plant of the Copper Queen Mining Co.

The C. & A. is opening up in the Copper Giant, situated near Mammoth, in Pinal county, Arizona, a large amount of concentrating ore, which will eventually be handled at the Douglas smelter. When the smelting capacity is increased, the present system of handling the charge and feeding the furnaces will still be in use. The ore and coke are drawn from steel bins into charge barrows and the furnaces fed by hand. There are 24 steel bins, each with a capacity of 100 tons. Besides the ore in these bins, there is a reserve pile at the smelter of about 3000 tons, and a reserve pile of coke of about 7000 tons. The amount of material on hand and the methods of handling the smelter charges are in sharp contrast to those in use at the Copper Queen plant, the C. & A. employing hand labor, and the continuous operation of the furnaces being dependent upon the regular arrival of the ore trains from Bisbee. The Queen, on the other hand, raises its ore from the large orebeds by means of steam shovels. These dump it into cars drawn by electric motors. The cars pass under the limerock and coke bins, where the charge is completed, and is then run to the feed-floor and dumped directly into the furnaces. The supply of material on hand is always sufficient to keep the smelter in operation for a month without being replenished.

SALT LAKE, UTAH.

Tintic Stocks.—May Day.—Uncle Sam Consolidated.—Government Assay Office.—Ohio Copper.—Bingham Central Railway.

All records were smashed by the Salt Lake Stock & Mining Exchange last week in the volume of business transacted. Lively scenes were witnessed, and when the official report was issued it was found that 1,515,863 shares had been transferred, which represented a selling value of $936,047. Trading was confined largely to Tintic stocks, some of which made sensational fluctuations—the leaders being Sioux Consolidated and Iron Blossom. Phenomenal strikes have been made in both mines, and the owners believe an extension of the famous Colorado orebody has been uncovered.

Inclement weather has greatly handicapped construction work at the new Tintic smelter, and it is now practically certain that the first furnace will not be in commission until about July 1. The sampling mill, however, will be running next week. The first custom ore has arrived from outside camps, eleven carloads having been consigned from the Silver Shield mine, in Bingham. The May Day Mining Co. will pay a dividend of 1 cent per share, or $8000, on June 24, to all shareholders of record on the 20th. This company paid $64,000 last year.

The financial report submitted to the shareholders of the Uncle Sam Consolidated at the annual meeting held June 1 shows gross earnings to the amount of $135,455 during the fiscal year. There were mined and marketed 42,670 tons of ore, having a net value of $26.42 per ton. Dividends were paid to the amount of $70,000. The company began the year $9000 in debt and has ended it with about $1000 cash in the treasury. Ore shipments ceased last December, when the United States smelter was closed. The properties of the Sevier Consolidated Gold, Silver & Prospecting Co., near Kimberly, Utah, have been sold under an execution for $108,206. This corporation expended something over $225,000 in the purchase of property, equipment, and development, but the management was not guided by any technical advice in planning development or deciding on the character of mill-equipment needed. When the panic came on last autumn the company found itself financially embarrassed; whereupon, a receiver was appointed.

The passage by Congress of a bill, which has received the signature of President Roosevelt, to establish a Government assay office at Salt Lake has been hailed with satisfaction by Utah mining men. The appropriation made for the purpose stated is $29,500. The annual meeting of shareholders of the Ohio Copper Co., which was to have been held June 3, has been postponed thirty days, during which time it is said all details will be arranged relative to financing the enterprise. Advices from the East indicate that new people are interested, and that F. Augustus Heinze has agreed to sell a large portion of his holdings, retaining, however, 100,000 shares. It will take from 60 to 90 days to complete

the mill at Lark, the construction of which began before the financial upheaval of last year.

A Los Angeles syndicate has acquired a large tract of coal land near New Harmony, and has organized a company to develop and operate it. The scheme involves the construction of a railroad to be used as a feeder for the Salt Lake route. Within 30 or 40 miles from the coal is the Virgin City oil district, in which vigorous development is being prosecuted. Within the past week two producing wells were brought in, one capable of producing 30 and the other 50 bbl. per day. There are now four producing wells in the Virgin district, with good indications for others being drilled.

The ore and bullion settlements reported through Salt Lake banks last week amounted to $381,000. Ore shipments from the Park City district this week were 805 tons; the Daly Judge contributing 238 and Silver King Coalition 567 tons. The Independent Smelting Co. will resume the operation of the smelter near Ogden this week. Custom ores are now being received. The plant is equipped with one copper furnace. The Bingham Central railway, a Heinze enterprise, and which is being worked in connection with the Ohio Copper mine in Bingham, has begun condemnation proceedings against the Fortuna Mining Co. for a right of way across the property of the latter, through which it is necessary to drive a tunnel to reach the Ohio mine. The Bingham road is projected to carry on a freight and passenger business between Bingham and Salt Lake City; also to the mill and smelting centre at Garfield.

BUTTE, MONTANA.

Option on Butte-Montana.—Davis-Daly Estates.—Snowstorm Output.—Amador Fiasco.—Tramway Shaft.

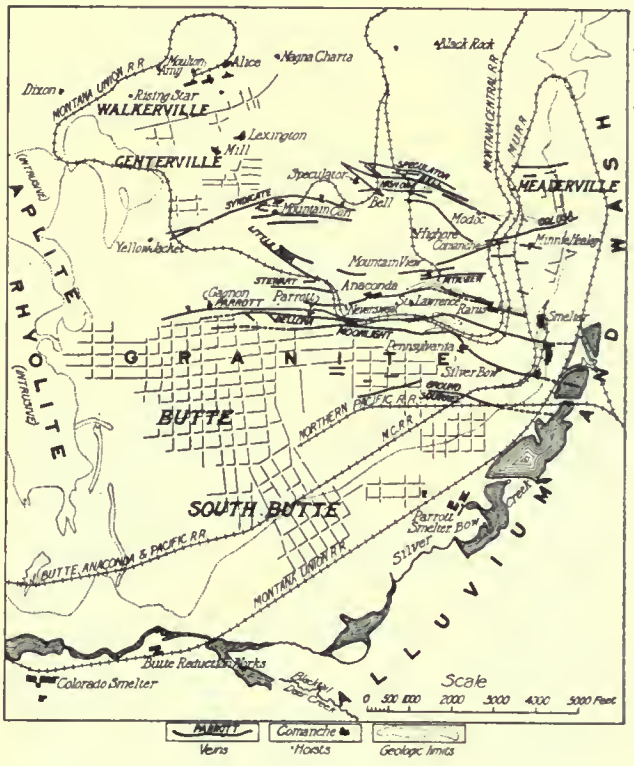
Recently a New York broker secured an option on a majority of the stock of the Butte-Montana Mining Co., which owns the Alex. Scott claim at Meaderville, adjoining the West Colusa of the Boston & Montana Co., and there are rumors current that he is acquiring the stock for the Amalgamated Copper Co. or for F. Augustus Heinze. The Butte-Montana Co. has been peddling its stock ever since it has been organized. The stock is selling at 30c. per share on the market, so it is evident that the option does not require the payment of much money. The Alex. Scott is being in a measure developed by the Boston & Montana Co., which is making connections through it with the West Colusa and Leonard for purposes of ventilation and safety. Under an arrangement with the Butte-Montana Co. it is sinking the shaft from the 700-ft. point to a depth of 1200 ft., and cross-cuts will be run from various levels to connect with the Boston & Montana workings. It is estimated that the Boston & Montana Co. will spend about $65,000 on the property, which is of direct benefit to the Butte-Montana, as it will develop the ground to a depth of 1200 ft. with no expense to the latter company.

Development is still going on in the Colorado mine by the Davis-Daly Estates Copper Co. A proposition has been advanced for reorganizing this company, but has never been acted on. The idea was a unique one. It was proposed to reorganize with a capital stock equal to the present capitalization and offer the new issue of stock in exchange for the present outstanding stock on a basis of one share of new for two shares of old stock. As there are outstanding about 750,000 shares of stock, that would return to the Davis-Daly treasury 325,000 shares. Having returned half their holdings to the treasury, the stockholders were to be given an opportunity to buy the stock back again, and put money in the treasury in place of the stock. The transaction would be equivalent to a heavy assessment.

Friends of F. Augustus Heinze who have returned from New York recently say there is little doubt that he will centre his activities here when he gets out of his financial and legal entanglements in New York. There is no gainsaying the fact that, notwithstanding his misfortunes, and the losses sustained by hundreds in Butte through him, Mr. Heinze still has many friends here, and it is possible that he could gather as large a political and personal following in Butte as he ever had.

Butte stockholders of the Snowstorm Mining Co. have received information indicating an early resumption of dividends. The mine is shipping 500 tons of ore per day, at an average cost of mining, it is claimed, of $1.06 per ton. The development work carried on during the shutdown greatly enhanced the value of the property, and it is now in condition to produce 1000 tons of ore per day without crowding.

According to reports from Chicago, the stockholders of the Amador Mining & Milling Co. have concluded that they were fleeced. The property is situated west of Missoula, Mont., and the flotation of the company was spectacular. Stock to the amount of $350,000 was sold and the money used for the construction of a railroad from the mine to the Northern Pacific track and for the erection of a $60,000 smelter before the mine was developed to a producing stage or its value at all demonstrated. In all, five cars of ore



Map of Butte District.

have been shipped from the mine, that did not pay treating charges. The company was organized about five or six years ago by D. E. McKinnon, a lawyer from Yakima, Wash., and capitalized for 2,000,000 shares at $5 par. It owns about 50 mining claims, a townsite, and railroad 10 miles long, built at a cost of $160,000, and a worthless smelting plant.

The Butte & Buxton Mining Co. is cleaning up the old workings preparatory to extensive operations. From a number of samples copper assays of 14 to 23% have been obtained, in addition to 11% lead, 40c. in gold, and 24 oz. silver per ton. The deepest working is about 150 ft. The company will sink several hundred feet at once.

The Butte Coalition Co. is shipping 1000 to 1100 tons of ore daily, mostly coming from the Rarus mine. It is asserted that the company is marketing its copper under a total cost of less than 8½c. per pound.

The new shaft of the Tramway mine, being sunk jointly by the Butte Coalition Co. and Butte & Boston Co., is down 1800 ft., which corresponds with the 1500-ft. level of the Minnie Healey, with which mine the Tramway shaft is being connected; however, the lowest present working of the Minnie Healey is 1100 ft. On the latter level the big orebodies recently talked about a great deal were opened last fall before the shut-down, and are not being worked at present.

Concentrates.

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

To remove rust from steel, immerse the article to be cleaned in a strong solution of cyanide of potassium, mix to the consistence of thick cream a paste of cyanide of potassium, castile soap, milk of lime, and water, and after immersion brush the steel briskly, using the paste.

Water-proofing for canvas which will leave the material soft and flexible may be made by boiling 1 lb. laundry soap in 6 pints water, and adding while hot 112 lb. white lead. Another good water-proofing for canvas and 'slickers' is made by boiling together 1 lb. flour of sulphur and 1 gal. linseed oil.

Cost of power per horse-power year, developed electrically by turbine water-wheels, ranges from $6 to $23 at various Eastern plants. It is sold at $13 at Niagara; at Lawrence, Massachusetts, it costs about $20, with a 1000-hp. installation. The average cost of steam-power would not exceed 0.8c. per horse-power hour.

Bituminous coals, as well as lignites and peat, will produce on an average 2.4 to 3 times as much power if used for the production of gas instead of steam. Another important item in the same connection is that low-grade coals which will not burn under boilers are capable of producing work by direct gasification in producers.

Gold precipitated on the fine particles of zinc detached when packing or cleaning the zinc-boxes in a cyanide plant may be almost wholly trapped by passing the overflow from the zinc-box through a compartment filled with 'excelsior'. The excelsior may be incinerated and the ashes mixed with the 'gold-slime' or precipitate for melting.

The first re-enforced concrete building in this country, and probably in the world, was erected in 1875 by W. E. Ward, near Rochester, New York. "Not only all the external and internal walls, cornices, and towers were constructed of concrete, but all of the beams and roofs were exclusively made of concrete re-enforced by light iron beams and rods."

The location survey for a placer claim or a mill-site does not differ from an ordinary land survey to establish boundaries. The corners are like those of lode claims, and are marked with the name of the placer or mill-site, and the number of the corner, on the side toward the claim. The tie-lines to reference monuments are also the same as in the lode claims.

Cement-making materials, namely, limestones with an admixture of clay or finely ground shale, usually in the proportion of three parts by weight of limestone to one part of clay, must be so proportioned as to bring the $CaCO_3$ in the 'mix' to about 76%, Al_2O_3 to about 5%, Fe_2O_3 to 2%, SiO_2 to 13%, and $MgCO_3$ not over 2%. Such a 'mix' will make a first-class portland cement.

Assay-values of gold ores as returned on British assay reports are given in grains, pennyweights, and ounces. The British habit in making approximate mental calculations from assays so stated is to take each grain of gold as representing 2d., each pennyweight 2s., and each ounce £4. An ounce of gold is actually worth approximately 85s., which would give a value of 2.125d. per grain.

Sale of an unpatented mining claim for taxes carries only the locator's title. To protect the title obtained through a tax sale, the purchaser at such sale must perform the annual work. If annual work is not performed and the claim is properly re-located, the re-locator will hold the claim as against the purchaser at a prior tax sale. He would also hold the fixed improvements found on the claim at the time of the re-location.

'Pitch', as used in relation to ore deposits, is the angle which the longitudinal axis of an ore-shoot makes with the direction of the dip of the vein. Similarly, it is used to denote the direction of movement of one or the other wall in faulting. 'Throw' is the vertical component, 'heave' is the horizontal displacement, and 'pitch' is the angle of divergence from the dip which the line of movement of the down-throwing wall has made.

Pitted gold bullion bars result usually from adding an excess of nitre and not leaving the 'melt' long enough in the furnace to permit the gases generated to escape. When oil or grease is used in the mold to prevent the bar sticking fast, gases evolved from these substances will also pit or roughen the surface of the bar. The best coating is produced by swabbing the heated mold with a lime-wash of the consistence of cream, just before pouring.

Phonolite is a rare rock, not occurring in many places in the United States, the most noted examples being at Cripple Creek, Colorado, where it exists as dikes through the older granite and breccia, and in the Black Hills, South Dakota, where the dikes cut through the Cambrian sedimentaries. The term signifies 'sound-stone' or 'clink-stone,' as it was originally called in England, because of the metallic ring which it gives on being struck. Many rocks, especially close-grained rhyolites, possess the same quality, but the name phonolite does not cover all those which ring, as 'porphyry' applies to all rocks which have crystals conspicuously developed in a groundmass of crystalline or sub-crystalline texture. It is a specific name for a compact, gray to brown, mixture of the glassy variety of orthoclase known as sanidine, and nepheline, with some hauyne and other accessory minerals in small quantities, but quartz is absent. It has a tendency to split into thin slabs and plates, sometimes suitable for roofing purposes. It decomposes readily, becoming rough and pitted, resembling ordinary trachyte, to which it is closely related.

Discussion.

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy.

A Theory of Ore Deposition.

The Editor:

Sir—The discussion of the subject of ore-deposition which has recently appeared in the MINING AND SCIENTIFIC PRESS has interested and entertained many readers, and inspires me with the belief that there is room for one more opinion. There is a tendency to assume the presence of water in intrusive igneous rocks, without an attempt to give any explanation of how it got there. In order to offer an explanation of how the presence of water may be accounted for in the interior magma of the earth it is necessary to assume that the planet was at one time in an incandescent condition, in which state it was so hot that all the materials composing it were rendered gaseous. While in this gaseous condition it was subject to all the laws of diffusion of gases.

According to the law of the diffusion of gases credited to Dalton, in a mixed body of gases each gas diffuses uniformly through the space occupied. Therefore all the gases composing the earth-sun, including water-gas, diffused uniformly through the mass from centre to circumference. As cooling caused a crust to form there remained, below the point of critical temperature, a complex magma in which water-gas is associated with all the other elements that are actually or potentially in a gaseous condition. As pressure increases the fusing temperature it is probable that the melting point and the critical temperature or absolute boiling point become the same. Owing to the higher melting point due to pressure there is probably no liquid material near the surface, nor at any point below the critical temperature of all matter, which would be reached at a depth of about 100 miles. The zone of flowage, which extends from the zone of fracture to the zone of critical temperature, is that zone in which all magma moves under pressure like wax and closes all openings of whatever nature.

If, as stated, the zone of critical temperature of all matter is reached at a depth of 100 miles, there is still remaining a sphere of 7700 miles diameter in which the water-gas is diffused as in the original earth-sun. By the process of secular cooling the materials that form solids at high temperature add to the thickness of the zone of flowage, and this liberates the water gas and all other gases associated with the original gaseous complex magma. After being liberated from their associated material these gases diffuse through the zone of flowage, up against the zone of fracture, and accumulate beneath natural vents, such as fault-planes and volcanoes.

When sufficient steam and other gases have accumulated to cause the rock to be super-saturated and highly elastic and vesicular, an old fault-plane is re-opened or a new one created, into which the steam and gases rush with tremendous pressure. The colder rocks of the walls of the fault-plane in all its ramifications present a large surface of lower temperature than the steam, and the consequence is sudden condensation, followed by closing of the fault-plane. This is the characteristic movement of an earthquake, and is repeated as often as the supply of accumulated steam lasts in the super-saturated magma below the zone of fracture. The super-saturated magma is carried along by the expansive force of the enclosed steam and penetrates the fault-plane as a dike. The combination of effects produced is the result of slow diffusion of water-gas and other gases through the zone of flowage resulting in local super-saturation of the magma below the zone of fracture at points where previous accumulations of the same nature have elevated the temperature and rendered it possible for steam above the critical temperature of water to get nearest the surface. If the steam has sufficient expansive force, it may issue at the surface as a hot spring, a geyser, or a volcano, and may carry with it a portion of the super-saturated magma and discharge it as liquid lava, or in extreme cases atomize it as volcanic dust. All of these phenomena are the results of a common cause and only indicate different degrees of intensity. The dike may never reach the surface in a fluid condition, and may be exposed by erosion in a subsequent geological age. A single irruption may be insufficient to carry the dike far into the fault-plane, and indeed it seems probable that many such earthquakes, each accompanied by a farther and farther penetration of the super-saturated magma, occur along a single fault-plant. With such a great store of steam in the interior magma, it is plain that wonderful effects will be produced by the gradual liberation which is due primarily to secular cooling. Such igneous intrusions as cause regional elevations without breaking through and overflowing on the surface are called laccoliths, and in some cases are of immense size. The Henry Mountains, in Utah, described by Gilbert, and the Black Hills, in Dakota, are familiar instances of this character.

The internal topography of the zone of fracture probably resembles the external topography, and causes the upward flow of steam to drain by diffusion toward well established vents, in the same manner but reversed action as the surface drainage conducts water to sinkholes in some limestone countries.

Having outlined what I believe to be the prime cause of all movements in the earth's crust, I now return to the question of ore-deposition. It has long been suspected that igneous rocks had something to do with ore deposition, and, in fact, as soon as ore is discovered in a new region the prospector begins to show its merits and relation to the nearest known igneous rocks.

It appears from the foregoing argument of the steam carrying forward the intrusive dike, that the presence of dikes in the vicinity of ore is as natural as it is frequent; and that ore is deposited from hot solutions resulting from the condensation of the steam that brought the dike up into the fault-plane. The dike may be the older, or it may be the result of a later and more violent intrusion of steam after the main part of the ore has been deposited. The dike is not the cause of the ore, any more than the ore

is the cause of the dike, but the two have a common origin, and the ore is the result of chemical action of the steam and other gases on the magma from which the dike was derived. After being dissociated from the gaseous magma, the steam is forced upward by the difference in specific gravity between it and the material of the zone of flowage. As to the effect of the associated gases, we have to consider that according to the original hypothesis all the gases that composed the earth-sun were present and diffused through the magma in the same manner as the steam or water gas. The gases which are known to be associated with steam in violent explosions are chlorine, hydrochloric acid, boron, hydrogen bi-sulphide, hydrogen, nitrogen, hydrocarbons, sulphur di-oxide, and carbonic acid. Some of these assist in solution of the metals, and others act as precipitating agents when the solutions have come near enough to the surface to cause the temperature to fall. It will be seen that a radical reduction of temperature is necessary for deposition, and this is probably the reason why mines do not grow richer with depth, in agreement with the popular idea and the prospectus. Hydrocarbons associated with mineral solutions are probably the cause of the precipitation of gold and silver and copper in a metallic state, where it is plain that they are not the result of secondary enrichment. As regards the general interest in this subject, I think that most men who have to do with mining and the treatment of ores have some theories on the subject, which they have arrived at, they hardly know how, and to which they cling with a constrictor-like obstinacy worthy of a better cause. A good many technical men are instinctively opposed to any idea not orthodox to the point of dry rot, and resist the introduction of heresy with heroic fortitude. A few of them would require a surgical operation to get a new idea on the subject unless it was proposed by some pundit who probably never entered a mine. On the other hand, it would require a deep incision to inoculate some of us with the theories proposed by some of the accepted authorities.

HIRAM W. HIXON.

Philadelphia, May 4.

A Protest.

The Editor:

Sir—I was considerably interested in the article 'From Mine to Battleship' in your issue of May 9, and find that there are a number of improvements in the desilverization of lead since the time when I was interested in lead smelting. I am writing, however, to protest against the abbreviation used for the symbol for acetic acid in the equations representing the transformation of lead into white lead. Coming from the pen of the editor of a journal that prides itself on its technical language, it cannot be overlooked, and I feel sure the writer of that article is the last person to wish that it should be. I am aware that a number of text-books, and good text-books, use these abbreviations, which is all the more reason for discouraging them. Thus we find chemical equations in which ammonia is expressed as Am, and cyanogen as Cy; the latter is most idiotic, as it contains the same number of letters as the proper symbol CN. So long as those radicals go in and out of combination like an elementary body, these abbreviations may serve, but directly the reaction is of such a disturbing character as to split them up into their elementary components, then an equation with an abbreviated symbol conveys no meaning. Take as a simple example, the equation expressing the reaction which occurs when concentrated sulphuric acid is added to dry crystallized potassium ferrocyanide.

$$K_4Fe(CN)_6 + 6H_2SO_4 + 6H_2O = 2K_2SO_4 + FeSO_4 + 3(NH_4)_2SO_4 + 6CO.$$

Here we at once see how each substance is broken up and re-combined and the equation balances. If we use the abbreviated symbols the equation will read:

$$K_4FeCy_6 + 6H_2SO_4 + 6Ag = 6CO + 2K_2SO_4 + FeSO_4 + 3Am_2SO_4.$$

Here we find symbols Cy, Ag, and Am on one side of the equation and not on the other, and the equation does not balance. Chemical equations have sufficient unavoidable stumbling blocks for the student without introducing unnecessary ones. As an example, take the foregoing equation and compare it with the equation which represents the reaction that takes place when sulphuric acid diluted with water is added to a water solution of ferro-cyanide of potassium:

$$2K_4Fe(CN)_6 + 3H_2SO_4 = K_2Fe_2(CN)_6 + 6HCN + 3K_2SO_4.$$

Note when concentrated acid and dry salt are used H_2O plays a part in the equation, and when acid diluted with water is added to a water solution of the salt it does not. Of course it is easily explained, but it is puzzling to the beginner.

H. F. MASON.

Johnsville, California, May 16.

[The exception is well taken.—EDITOR.]

Electric Furnace in Zinc Smelting.

The Editor:

Sir—I desire to bring to the attention of your readers, particularly those in the Western States living near cheap electric power, and those producing zinc ores, a subject of vital importance, namely, the possibilities of the electric furnace adapted to zinc smelting. The electric furnace is a comparatively new thing, commercially at least. It is only a matter of a few years since electricity has been applied metallurgically. Without the electric furnace, the alkali metals and aluminum would not be cheap commodities; and such valuable materials as carborundum, ferro-silicon, vanadium-manganese, etc., calcium carbide, boron carbide, etc., would be unheard of. While many have endeavored to produce zinc by electrolysis, the method has not yet proved satisfactory from the standpoint of dollars and cents, although zinc can be deposited electrolytically under proper circumstances.

Taking my own experience with the resistance of electric currents passing through metals and graph-

ite as a criterion, I propheey that zine ean and will be produeed eommereially in an eleetrie furnaee. I find a remarkable uniformity in the heat produeed by resistanee. Take niekel wire, for example; its resistanee is very high; niekel is strong, tough, not readily affeeted by heat, durable, has a high melting point, and ean be drawn into a wire which is uniform. A small resistance-furnaee made with niekel wire gives uniform temperatures, and what ean be done with a small furnaee, I believe ean be done in a large one with still greater uniformity. Moreover, the shape of a furnaee could be made to suit almost any eondition, there being no need to arrange for grates, eombustion-chambers, or staeks, like the ordinary zine-furnaee. Besides this advantage, eeonomy of heat lost by radiation, small spaee required, eeonomy of redueing material in the furnaee-charge, and greater eomfort for the workmen are advantages to be considered. The electrie pyrometer or galvanometer would indicate instantly the temperature of the furnaee, and the eontrol of the temperature would be almost as readily fixed as the indication of temperature. The present gas-fired, or the older eoal-fired furnaee, requires skilled furnaee-men and judgment in gaining the proper heat. If too hot, it takes considerable time to adjust the heat, and if too eold, it takes even longer to fire up. With an electric furnaee, all that is neeessary is to regulate the current a little and the furnaee responds in a few minutes.

An eleetrie furnaee could be designed whereby the problems of eharging, smelting, and removing the retort-residues could be redueed to a minimum of labor, owing to its compaet shape and freedom from the necessity of constructing grates, etc. I believe it is the duty of every mining man who is near to ore and power to investigate this proposition, and I suggest that these men experiment and perfeet this process, either by themselves or by pooling their interests.

T. J. Brewster.

Hercules, California, May 16.

Bogus Promoters.

The Editor:

Sir—As an old subscriber of your paper I trust that you will allow me a small space in which to make some remarks eoncerning the various so-called promoters infesting Mexico at the present time. It is certainly strange that sensible and successful business men from all parts of the United States and from Europe, should be such dupes when face to face with some well dressed individual giving a beautiful highly tinted pieture of the wonderful mine or mines he is bent upon selling. Some time ago, all these mines were copper properties, now they are gold; metals change even as prices do on Wall Street, and now 75% of such mining in the hotel of Mexico City is gold, and especially 'placer.' By the way, I was informed that a placer had been loeated here that ran $40 per eubic metre. Of course, being told such Arabian Nights tales in a fashionable hotel, one must grip his ehair and smile, but it certainly outshines anything that Humboldt or our loeal papers, with all their vivid imagination, dare to dream of; yet, business men day after day are induced to part with hundreds of dollars to grafters, and often take long and hard journeys to see alleged wonders, and return cursing mines in particular and mining men in general, never realizing that all their loss and trouble were due to giving ear and eredit to a perfect stranger in a strange hotel in a foreign land, in whieh, moveover, they are more than strangers, being in many instances ignorant of the language, and above all, of the character of the people.

This absolute stealing of money by means of spurious tales and unserupulous lying is not practised entirely among the visitors, but even among resident engineers and investors. Only a few days ago, I was with two other experts in the State of Michoacan, and we were accompanied part of the way by a well known mining engineer and expert, a man of means and influence, and being well known to us, he mentioned his reason for his journey, and when he had finished, I and another coolly informed him that he was on a wild-goose chase, sinee we had each at different times been interested in the mine by the same grafter. To my own certain knowledge, this person had obtained money from several people at different times for pretended locations or inspections, which he had never made and had no right to make, and more than one engineer had made the journey to see the mine, and had never seen it, for the simple reason that the given directions required about three days' journey from the actual spot; yet this rogue has been receiving money from people for his information and bogus inspections.

There is no need for investors to be caught or to buy gold-bricks here in Mexico. If they would only give the same attention to the promoter, and exercise the like caution as they must do in their several businesses at home, they would get good properties, not bonanzas, nor properties containing the romantic wealth described by Humboldt, but a good return for their money; they would prevent Mexico from being looked upon as a well into which the stranger is expected to drop his money; and this will be brought about when the would-be investor consults with known and reliable mining men, and gives the hotel lobby hunters a much deserved snubbing.

H. F. M. Crooksbanks.

Mexico City, May 1.

Surface Enrichment in Sonora.

The Editor:

Sir—After extensive observation of the mineral deposits of Sonora one is led to the eonclusion that some parts of this eountry are notable for the richness of the surface ores as eompared with those eneountered at moderate depths. The writer does not, by this statement, intend to convey the impression that many of the orebodies become commercially worthless at a moderate depth, but it is true that, in many eases, as development progresses, the assay-value becomes redueed and often the discovery of rich ore at the surface has led operators to install metallurgical plants that have soon become useless on aeeount of a radieal change in the ore. In free-milling gold veins sulphides often appear at a few

hundred feet of depth and totally change the metallurgical conditions.

In many regions which produce copper it has been found that this metal has been leached out at the surface and concentrated at a lower level; but in northern Sonora there are myriads of copper deposits in which the surface ores are rich, while at a depth of from 200 to 400 ft. the primary ore is reached with only a shallow zone of secondary sulphide enrichment intervening.

The surface ores are largely silicates. Varieties of dioptase predominate and yield frequently assays of 25 to 45% copper. Carbonates are relatively rare. The primary ore is generally iron pyrite containing from 2 to 6% copper, and the cleavages are usually coated with a film of secondary chalcopyrite. The practical miner and the promoter generally assume that this yellow mineral is pure chalcopyrite and base their calculations on a copper content of over 30%, much to the detriment of the ignorant investors who are attracted by their statements. In silver mines also, ores are encountered near the surface rich in native silver, horn silver, and tetrahedrite.

Two features are therefore especially notable here in respect to copper, gold, and silver: (a) that the zone of alteration is comparatively shallow; (b) that the surface ore is often extremely rich.

Since the superficial changes in orebodies are especially dependent on the action of the surface waters, we are led to consider what relation these local phenomena have to the Sonora climate. The rainfall of northern Sonora is well known to be very light. Carefully kept records are lacking, but the average precipitation at Tucson, Arizona, for 11 years was but 11 in. per year, the minimum being less than 8 in. On the other hand, the annual evaporation is upward of 60 in. It is reasonable therefore to attribute the shallowness of the alteration to the lack of water and the richness of the surface ore to lack of erosion.

The chemical actions and reactions and the exact physical conditions by which gold and silver are concentrated in surface rock are not fully known. The formation of the rich silicate ores of copper may well be due to the action of circulating waters, since the descending waters carry carbonic acid rather than silica. This is well shown by the abundant formation of the calcareous deposit known as *caliche*, its lime being in many places chiefly derived from the feldspars of volcanic rocks by the solvent action of atmospheric water. Of course, to these generalizations, there may be many exceptions. There are in Sonora, gossans underlain by commercial ores and there are many barren gossans that have never been explored. Further, in some mines relatively rich ores have persisted to a substantial depth. At La Sultana good ore is found to a depth of 1000 ft. or more. At Minas Prietas secondary enrichment has persisted to the lower levels in the rhyolite, though in the underlying granite ore is lacking. At Cananea some of the gossans covered good ore. These conditions, however, seem to be exceptional rather than regular, for this region, and may be due to special local causes, which can be determined by careful study. A fact of interest, frequently observed in Sonora, is that sulphides often occur far above the permanent water-level. This in turn must be attributed to the limited action of the surface water, which is usually the most active agent in oxidation.

It will be of interest to compare notes on these points with other observers in arid regions, and possibly some rules of the relation of climate to secondary enrichment in ore deposits may be established for the guidance of prospectors.

F. J. H. MERRILL.

Nogales, Arizona, May 29.

Cyanide Costs.

The Editor:

Sir—In view of the fact that the precipitation and clean-up costs at various cyanide plants have been recently published, the following summary of these costs at the Liberty Bell mill may be of interest. The figures are for the month of March, 1908, and therefore represent present practice; they are complete only as to labor, supplies, and power, and do not include the distributed charges of heating, lighting, superintendence, and depreciation.

Ore milled (tons of 2000 lb.)	10,548
Solution through zinc-boxes (tons)	24,510
Precipitate recovered, washed and dried (lb.)	1,275.5
Bullion from same (oz.)	16,016.8
Metal in precipitate (per cent)	86.1
Bullion fineness (gold and silver per 1000)	950

COSTS.

PRECIPITATION.		
Zinc, 4700 lb. at 8.97c. per lb.	$421.60	
Cutting	65.00	
Labor	81.55	
Power and supplies	26.65	
		594.80
CLEAN-UP AND FILTER-PRESSING.		
Labor of cleaning and re-packing boxes, and de-watering precipitate (There are 12 five-compartment boxes, each compartment having 20 cu. ft. of zinc space.)		43.50
REFINING.		
Acid treatment and washing.		
1050 lb. sulphuric acid at 4.6c. per lb.	$ 48.30	
Labor	55.30	
Power and repairs	8.45	
	$ 112.05	
Drying and melting.		
Coal, 750 lb. at $6 per ton	$ 2.25	
Coke, 2500 lb. at $17 per ton	21.25	
Flux	32.75	
Crucibles	36.00	
Labor	29.00	
Repairs and sundries	3.05	
	$ 124.30	$ 236.35
Total cost		$874.65

COST PER TON OF SOLUTION.	
Precipitation	$0.0243
Clean-up and filter-pressing	0.0018
Refining	0.0096
Total	$0.0357
Refining cost per Troy ounce of bullion	$0.0148

W. A. MOULTON.

Telluride, Colorado, May 1.

RECENT WORK ON THE COMSTOCK.

Written for the MINING AND SCIENTIFIC PRESS
By WALTER D. O'BRIEN.

The drainage of the Comstock mines twenty-five years ago was accomplished by a pumping plant the moving parts of which weighed 6,496,400 lb. This enormous weight was raised and lowered 10 ft. nine times per minute. In the Cornish system of pumps then in use 2.7 miles of pump-rod were employed, which, with the balance-bobs, pumps, and moving parts, actually weighed 2230 lb. for every gallon of water raised. A train of cars nearly a mile long would be required to transport this machinery. Can one then wonder that when this stupendous plant was found inadequate, pumping ceased and the mines were allowed to fill with water?

The abandoned pumps, not including foundations, installation, or freight, cost about $1,300,000. Their maximum pumping capacity all told was less than 5400 gal. per min., raised to an average height of 1152 ft. The cost of operating this plant was about $58,120 per month, or $697,440 per year. This did not include the cost of broken parts, but represented daily operating expenses for pumping alone. One would think that such a plant could pump the ocean dry, but it could not handle the water of the Comstock lode. The old records show that in almost every instance where any extensive prospecting work was tried on the lower levels, heavy flows of water were encountered.

In February, 1882, a heavy flow of water from the 2810-ft. level of the Exchequer mine, estimated at 120 miner's inches, flooded the lower levels. The pumps were run to their full capacity, but the water still rose, and not being able with pumps and bailing tanks to control it, all pumping operations were stopped for good on March 28, 1882.

At the time the lower levels were abandoned, the pumps were daily discharging about 4,000,000 gal. hot water (in some places the water was, and still is, 160° F) to the Sutro Tunnel level. The expense of these operations, under the then existing conditions, was enormous, so that finally one company after another withdrew its financial support, and the greatest of all gold and silver mines were practically abandoned, until the Comstock Pumping Association was organized in 1898.

This association was originally composed of 24 mining companies, and each company agreed to defray its percentage of the expense of unwatering the mines. The water then stood a few feet below the Sutro Tunnel level; in fact, some of the South End mines were then overflowing into the south lateral of the Sutro Tunnel.

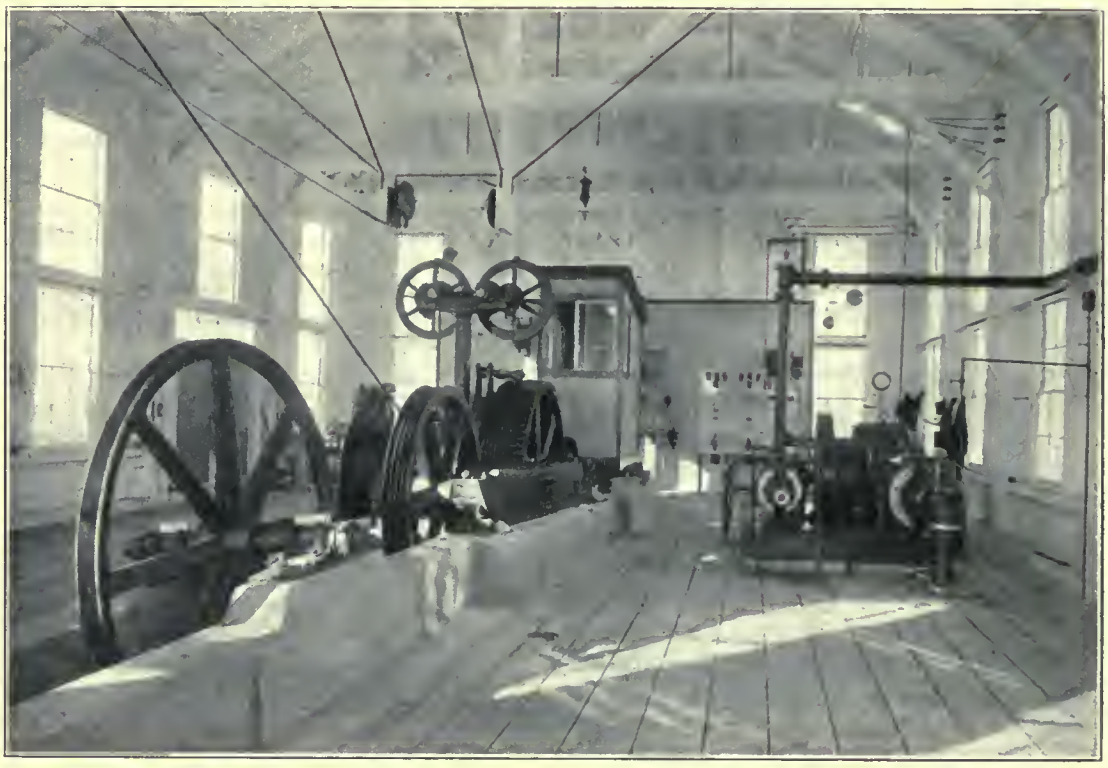


Fig. 2. Hoisting Plant at Union Shaft.

The old superintendents who had charge of the mines previous to 1886 made extensive reports on the conditions and the amount of ore in reserve before the mines were closed down. These reports showed that $600,000,000 had been extracted from the Comstock lode, and that the lower levels had not been thoroughly prospected, on account of the flow of water. In many instances known bodies of good milling ore were left in the old workings.

The best engineers in the country were then employed to devise ways and means of unwatering the mines and to design and equip the mines with the most modern pumping plants. For nine years the Pumping Association has kept alive the old mines, and the fruits of its past efforts should be realized from one to three years hence.

Instead of trying to open each of the old shafts, groups of the companies combined to repair and operate through common shafts. The shafts that drain the different mines are the C. & C. shaft and the

Ward shaft. The Union shaft is also below the Sutro Tunnel. The mines are now drained to the 2550-ft. level of the Ward, 2450-ft. level in the C. & C., and the 2450-ft. level of the Union shaft.

By the use of hydraulic elevators, the water in the C. & C. shaft was lowered from the Sutro Tunnel level to the 2150-ft. level, it having required 200 miner's inches under a pressure of 900 lb. per sq. in. to accomplish this feat. On the 2150 level of this shaft three $6^{11}/_{16}$ by 24 in. Riedler pumps have been installed. Fig. 1 shows these pumps in place. The station containing the pumps is 20 by 20 by 119 ft. in the clear. The timbers are 14 by 14 in. and lagged. These pumps have a capacity of 4500 gal. per min. and are operated by means of three 200-hp. Westinghouse induction motors. They handle all the water in the North End mines, lifting the water from the 2150 level to the 1650 or Sutro Tunnel level, through which it is discharged.

By the use of hydraulic pumps, the water has been lowered to the 2475-ft. level, where there is installed a hydraulic pump that makes one lift of 3000 gal. per min. to the electric Riedler pumps on the 2150 level. For operating this pump 1400 gal. per min. pressure water is used, under a pressure of 1100 lb. per square inch.

On the 2400-ft. level of the Ward shaft there is an electric pump, operated by means of a 200-hp. motor at 1720 rev. per min., that makes one lift of 900 ft. to the Sutro Tunnel level, pumping 600 gal. per min.

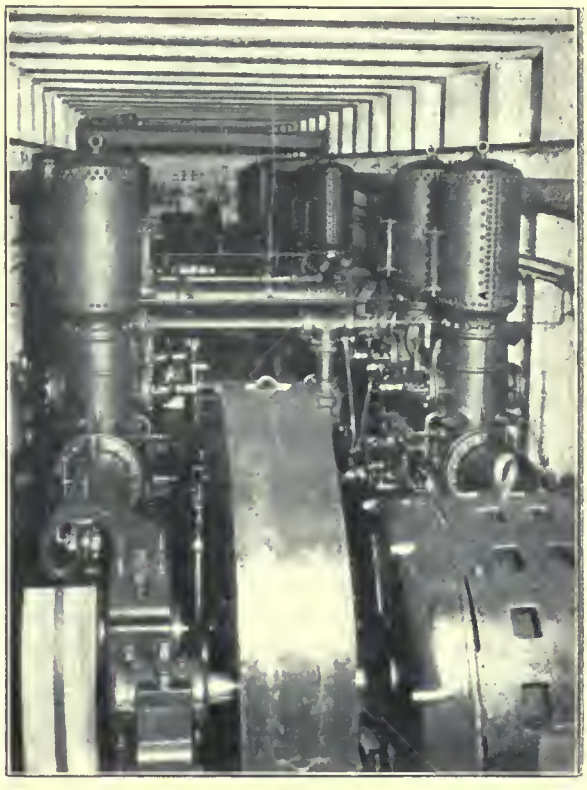
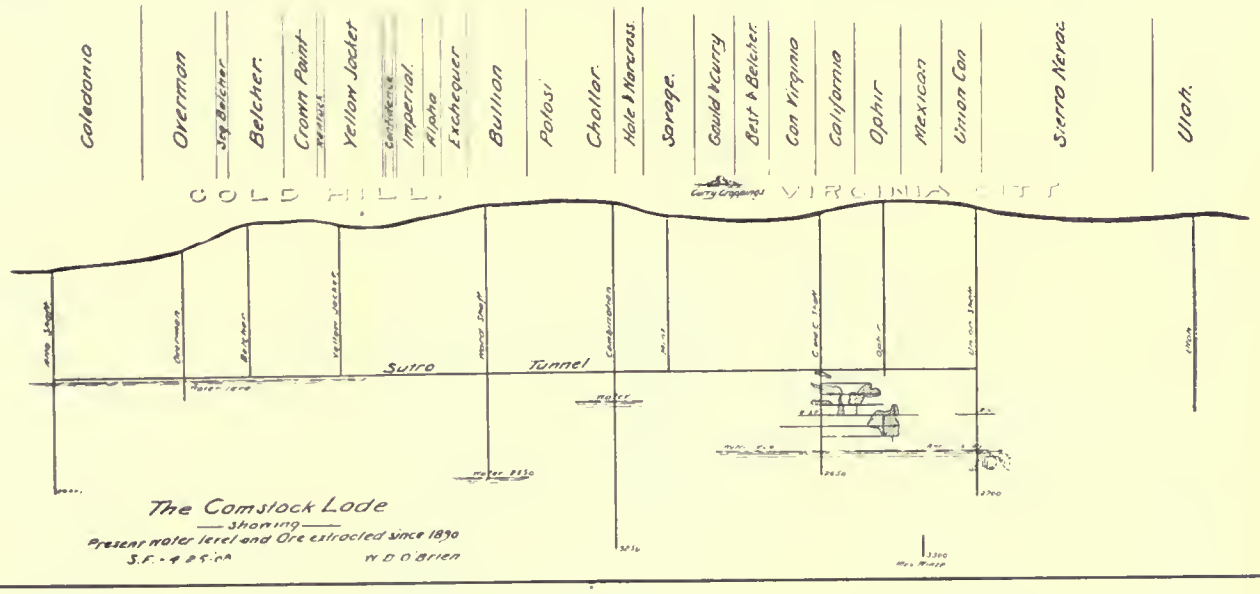


Fig. 1. Riedler Pumps, at the 2150 ft. Station of the C. & C. Shaft. Capacity 4500 Gal. per Minute.



On the 2475-ft. level of this shaft the finest electrically driven pumping plant in the world is now being installed. The capacity of this one unit of the ultimate system is 1650 gal. per min. The mine will be equipped with this unit to sink to the 3100-ft. level, where a second unit will be installed.

The cost of this new pumping system, not including installation, was about $200,000, this price covering the two new units on hand and to be installed in the Ward shaft. Compare this cost with $1,300,000, the cost of the antiquated pumping plants. The capacity of the old installation was about 5,000,000 gal. daily, as against 9,000,000 gal., the capacity of the new installation.

The following gives an itemized list of the present monthly expenditures and costs of operating the pumps to unwater the mines on the Comstock lode:

C. & C. SHAFT.

Electric power	$2360
Water power	2200
Labor	900
Labor changing throats	25
Repairs and renewals	400
Oil waste, etc.	100
Compressed air	100
	$6085

WARD SHAFT.

Electric power for pumps	$1125
Electric power for compressor	400
Labor	660
Repairs, etc.	100
Oil waste, etc.	75
	$2360

The total monthly cost of pumping is, therefore, about $8445, as against $58,120, the former monthly expense of operating the abandoned pumping system, of less than half the capacity of the new, which makes a saving of $596,100 per year. The present pumps also save from $50,000 to $100,000 on repairs and new parts not included in the above saving.

A hoisting plant recently installed in the Union shaft is shown in Fig. 2. It is operated by means of a 100-hp. General Electric motor. This hoist handles 20 tons an hour from the 2000-ft. level, at a cost of about 3 cents per ton for power. This does not include expense of engineering or mining. The hoist uses a continuous cable with two cages. A similar hoist is installed at the C. & C. shaft and is set up back of the old steam hoist now in use.

The accompanying tabulated statement gives a list of the shafts that have been opened up below the Sutro Tunnel level and the orebodies extracted since the organization of the Comstock Pumping Association. Outside of the Consolidated Virginia, Ophir, Mexican, and Union, there has been little or no development work done below the Sutro Tunnel since the unwatering of the Comstock. When the new pump is installed on the 2475-ft. level of the Ward shaft, connections can be made with the Combination shaft and the mines can then be drained and explored to a depth of 3100 ft. with good ventilation.

From the foregoing, it can be readily seen that the management of the Comstock mines, through the Comstock Pumping Association, has in the past nine years done everything in its power to install the most up-to-date mining machinery, and has equipped the mines with plants that will permit of the exploration, thorough prospecting, and development of the lower levels. Whether or not the miners will again find large bodies of rich ore remains to be seen.

A method of raising oil from deep wells has recently been developed by Bruno Leinweber, of Vienna, Austria. The essential feature is an endless absorbent band hanging in the well, the lower loop immersed in the oil. At the top of the well the band passes between a pair of rollers, which squeeze the oil from it. The band is made of flat hempen rope, faced with an absorbent fabric having a long nap. This device has been tried experimentally in a well 1700 ft. deep by 9 in. diam., using a band 3 in. wide and 0.3 in. thick, having a facing 2½ in. wide and 0.8 in. thick. The hoisting mechanism imparted a speed of 8 in. per second to the band. In spite of this slow speed, and other imperfections in the details of the machine, the oil was raised at the rate of 0.85 lb. per yard of band-length. It is claimed for the device that it may be used to depths of 5000 ft., in either vertical or inclined bores, and is applicable for lifting the heaviest and thickest oils, as well as those containing paraffine and sand.

Molybdenum may be determined qualitatively by adding H_2O_2 to concentrated solutions, followed by a little excess of NH_4OH, producing a brownish red color. The color is discharged by large excess of NH_4OH or by dilution. A perceptible reaction was observed with 0.001 mg. MoO_3.

ACCUMULATION AND ABSORPTION OF GOLD AMALGAM BY COPPER PLATES.

In the bulletin of the Institution of Mining & Metallurgy, Edward Halse gives the results of experiments showing that actual absorption of gold into the copper is practically a negligible quantity, in no case exceeding a fraction of a grain to the ton of ore milled. A separate paper on the same subject by W. F. A. Thomae expresses a judgment in full accord with this, setting the limit of absorption at not more than 10 oz. to a plate 4 ft. 6 in. by 12 ft. The experience of Arthur L. Collins at the Hidden Treasure mill, at Black Hawk, Colorado, is recalled, where plates in use 10 years yielded 8 oz. fine gold after being thoroughly scoured. It is pointed out that a copper plate will absorb mercury to saturation, which point is reached at about 1%, in approximately 16 days. The gold, instead of penetrating the copper, tends to accumulate in the form of hard scale upon its surface. The effect of silver-plating is to restrain absorption at first, since the mercury has to diffuse through the silver, but eventually the absorption reaches saturation as in the case of plain copper. The rate and amount of accumulation of hard scale varies extremely under different conditions. Comparisons between long-continued observation on this point at the Drumlummon mill, in Montana, and at the Sucre mill, in Colombia, show such wide discrepancies as 0.499 and 1.721 dwt. fine gold per ton of ore milled at the two places through periods of about two years. The gold recovered by regular clean-ups at these two mills was respectively 4.65 and 9.49 dwt. per ton of ore. The rate of accumulation roughly follows the grade of the ore, and it is found, as might have been expected, that the proportion of silver present materially affects the rapidity with which the scale will form.

Building operations in 1907 in the United States show a decrease over those of 1906, but an increase over all previous records, according to a recently issued report of the U. S. Geological Survey. The total cost of the buildings erected in the principal cities of the United States in 1907 was $661,076,286, a net decrease of $17,634,683, or 2.6% from the figures of 1906, but an increase of 2.55% over those for 1905, and 40.86% over 1904. The unit cost of building, however, increased in the past year. In the cities showing a decrease in building, New York takes the lead with a falling-off of $41,591,982, or 26.84%; St. Louis is next with $8,045,526, or 26.87%; Chicago next with $5,616,245, or 8.68%, and Brooklyn last with only $149,304, or 0.21%. Naturally, San Francisco leads the list in the increased building operations. The total number of building permits issued during 1907 was 12,126, for buildings to cost $91,502,240, an increase of 162% over the building in 1906. In 1905, before the fire, the cost of building operations was only $18,268,753.—*Engineering News.*

To anneal the core of an electro-magnet, first heat it to a low red and cool in soft soap: then reheat it to the same point and allow it to cool while covered in slaked lime.

ROUND MOUNTAIN, NEVADA.

Written for the MINING AND SCIENTIFIC PRESS
By GEORGE A. PACKARD.

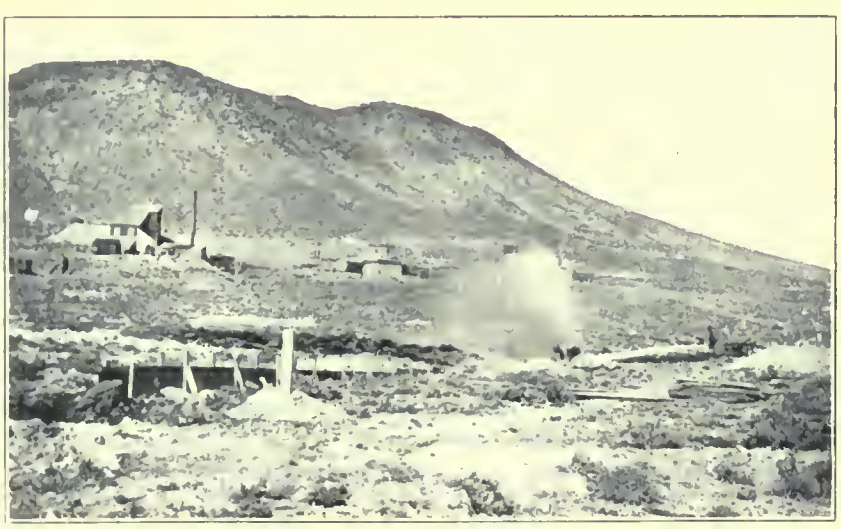
The camp of Round Mountain is situated on the east side of Big Smoky valley, two miles south of Jefferson canyon, and four miles from the site of the old camp of Jefferson, which was a prominent silver producer over thirty years ago.

The most convenient route to the camp is by automobile from Tonopah by way of Manhattan. The distance from Tonopah to Manhattan is 52 miles by the auto road, and from Manhattan to Round Mountain 29 miles. The machines usually follow the old stage-road to Austin, well toward the west side of the valley, crossing back to the east opposite the camp. The daily stage from Manhattan keeps near the foothills of the Toquima range and by this road the distance is only 18 miles. Freight is transported over the Nevada Central railroad to Austin, from which point there is a 52-mile haul over a good road. The site of the town, which has a population of about 500, is on a broad flat gravel slope, offering excellent drainage. Water for domestic purposes is hauled from Shoshone canyon, a mile north.

Town of Round Mountain, Nevada.

The mountain from which the camp receives its name is a low flat-topped rhyolite hill, rising less than 400 ft. above the surrounding country, and connected by a ridge toward the east with the Toquima range. On the west slope of Round Mountain is the Sunnyside group of the Round Mountain Mining Co., the most developed property in the camp. On the same slope, to the north, are the Great Western, now controlled by the Round Mountain Co., the Black Hawk, and the Sphinx. Along the connecting ridge are the Antelope, Daisy, and Fairview, all in rhyolite. On the northerly slope of this ridge, near the east line of the Fairview, is a contact with granite, and in the Fairview tunnel the granite has been encountered underlying the rhyolite, and dipping toward the valley.

Several dumps northwest from here, toward town, show granite, and the inference is that the ore-bearing area may not be found to extend farther in this direction. On the Daisy, in the hollow between the ridge and Round Mountain, and about 400 ft. west of the Fairview tunnel, is the 175-ft. shaft of the Crescent lease, the dump of which shows, besides the surface rhyolite, much fine slate. Here the rhyolite contains inclusions of both granite and slate. A few hundred feet farther west a shaft sunk by the Daisy company is said to have encountered quartzite at a depth of 170 ft., and after passing through 35 ft. of this entered calcareous slate. The rhyolite in the Black Hawk tunnel is quite dark, showing hornblende and biotite, with both feldspar and quartz phenocrysts. More commonly it is light and much kaolinized. W. H. Emmons and G. H. Garrey,* consider the rhyolite at Manhattan as belonging to the Tertiary. Presumably this is of the same period. The granite contains, in addition to the quartz and feldspar, widely varying amounts of muscovite, and shows a gneissoid structure. The shearing indicated by the structure of the granite is confirmed by the appearance of the rhyolite, the specimens of which indicate stress, alteration, and leaching.



Sunnyside Mine and Mill. Starting New Pit with Giant of the Round Mountain Hydraulic Co. in Foreground.

The veins are of two classes. The larger appear to occupy zones of shearing, if not of actual faulting, and the ore is rhyolite, more or less silicified and altered, often showing much iron oxide. These veins are comparatively flat, though varying much in both

* 'Notes on the Manhattan District,' Bull. U. S. G. S. No. 303

strike and dip. The main Sunnyside vein has a general northwesterly strike, but at one point makes a turn almost at right angles. The dip near the surface is northeast at an angle of 40°, but it flattens to 30° below. An interesting peculiarity is the frequent short drops in the hanging wall, as much as 18 inches, suggestive of step-faulting. In the upper levels the foot-wall is not well marked, and panning is the only method of determining what shall, or shall not, go to the mill. In fact, excepting in the case of the high-grade ore, there is little in the appearance of the ore to indicate its value. A piece of white rhyolite, apparently unchanged except for kaolinization, may run $2 or $200. The veins of the second type appear to occupy narrow fissures in the rhyolite; these are nearly vertical, but have a direction similar to that of the flatter veins. These seams, from a knife-blade to an inch thick, and of limited extent, are often very rich. They sometimes carry half an inch of almost solid gold, and appear to be the source of the gold that has made the dry-washing of the surface-gravels profitable. Rich pockets frequently occur where these vertical seams intersect the main vein. The gold occurs in finely divided particles disseminated through the ore, or in flakes, plates, and wires made up of connected fine crystals. Some specimens look like crushed masses of golden moss.

The main shaft on the Sunnyside has reached a depth of 550 ft. on the incline, and the vein, which near the surface was about three feet wide, is 22 ft. wide on the 450-ft. level. At the time of my visit, in April, the vein had been cut on the 550-ft. level, but the width had not been determined. The length of the pay-shoot had been proved for 400 ft. Another shaft, about 1000 ft. east, is also in ore, but whether it is on the same vein has not been determined. The Sphinx has a shaft 200 ft. deep and some drifts, but the mine was closed at the time of my visit, though it was to be re-opened in May. The Fairview has a long tunnel and considerable stoping ground, from which 20 tons is hauled daily to the mill on Shoshone creek. The Daisy and Antelope are principally developed by lessees. The Mulholland lease is said, by the secretary of the company, to have yielded $60,000 in a few months after the discovery of the camp. Much of this was very high-grade ore from which the gold was pounded out in mortars on the ground. Interesting stories are told of the shipments by suitcase, "which it took two men to lift into the buggy." There are six lessees on the Antelope. From one of them 12 tons shipped netted $700 per ton, in addition to which about 200 tons treated at the local mill yielded $32 per ton. The vein along the ridge where these claims lie has a northeasterly strike, and dips southeast near the surface. I was told that in the Antelope it straightens up and with depth dips northwest at an angle of 37°. This vein is from two inches to four feet in width. There is no work below the 100-ft. level on this property.

The manner in which the vein on the Antelope was discovered is interesting. The property was acquired soon after the discovery of the Sunnyside vein by C. C. Boak and others. A California pocket-hunter was hired to "post-hole the ground" and try to find a vein. In the course of his work the Californian panned the dirt at the mouth of a badger's hole, with such astonishing results that he jumped on his horse, rode to Manhattan, and telephoned Mr. Boak at Tonopah. The owners immediately secured an automobile and were soon on the ground, opening up the badger's hole. At the bottom they found his nest of sticks and straw on top of rock on which was a solid gold plate covering half a square foot. This specimen is still preserved at the company's office.

For the mill-man Round Mountain is a Paradise, in striking contrast with some of the near-by camps. Thus far the ore contains no sulphides. It is soft, and even with coarse crushing over 90% of the gold is saved on plates. There are now four mills operating in the camp. Those of the Round Mountain Mining Co. and the Fairview Co. have been in operation a year. The former is the largest and handles about 80 tons per day. It was erected at the mine, water being obtained from the Hydraulic Co. The ore, after passing a jaw-crusher, goes over a grizzly, whence the coarse goes to a bin, from which Challenge feeders deliver it to two Nissen stamps. The fine is similarly delivered to two 5-ft. Huntington mills. The former have a 16-mesh Tyler rolled slot screen, while the latter have a screen of the same type but about 25 mesh. The stamps are crushing about 10 tons each, and the Huntingtons 30 tons each, per 24 hours. Each of these machines is followed by amalgamating plates 10 ft. long, with a drop in the middle, but in the case of the stamps wooden riffles have been placed over the lower half of the plates. The tailing from the plates passes through a 9-ft. tube-mill and thence over two more amalgamating plates 5 by 8 ft., in parallel. I doubt if the final product would be finer than that which is ordinarily delivered through a 30-mesh screen. In nearly all cases the plates are given a fall of quite two inches per foot.

The Fairview mill is on Shoshone creek, one mile north, and consists of a grizzly, crusher, elevator to bin, feeder, and 6-ft. Huntington mill, with plates. The screen here is finer, both 30 and 40 mesh being tried, and the capacity is only 20 tons per day. All crushing is done on one shift.

The other two mills are but recently installed. The one at the Sphinx is a Huntington, and is being started on ore from the dump. The other, a 6-ft. Elspass mill, is a custom-mill, on Shoshone creek, now treating ore from the Matley & Morley lease, on the Great Western. While the district produces some high-grade ore, the bulk of the ore milled yields between $10 and $20 per ton, and in some cases less.

Power for mining and milling purposes is obtained on some mines from fuel oil, costing about 52c. per gal., and on others from burning wood, costing from $8 to $10 per cord. It is noticeable that the Sphinx, which has a gasoline hoist, put a wood-burning boiler in its mill. In Jefferson canyon there is a good stream of water, said to flow all the year around. All the water rights below the old Jefferson mill-sites have been purchased by the Daisy Mining Co.

and leased to the Round Mountain Hydraulic Co. By purchasing the old mill-sites, very nearly 1000 ft. fall for this water could be had and considerable power obtained at Round Mountain, but at present the water is more valuable for placer-working.

Large areas of the surface are covered to a depth of from 2 to 10 ft. with gravel enriched with gold by the erosion from the numerous small seams. At the time of my first visit, in 1906, Thomas Wilson had a lease on a portion of the Sunnyside, from which, with two dry-washing machines, he took out $30,000 in 70 days. This ground averaged over $5 per yard. Later, sufficient water was obtained for a sluice-head, and last year a considerable area was sluiced. Encouraged by the results obtained, the Round Mountain Hydraulic Co. was formed, the water rights owned by the Daisy Mining Co. were leased, and a 16-in. pipe-line laid down to bring water from Jefferson canyon. To this is being added the water from Shoshone creek, and it is expected to operate three giants. A large portion of the surface area of this camp is now under lease to the Hydraulic Company.

Concrete should not be mixed so wet as to wash the cement-mortar off the stone or aggregate used. Ram all concrete; its strength sometimes is increased 50% by thorough ramming. Do not attempt to ram concrete under water; the cement, if you do so, will be washed off the sand and stone forming it. In hot weather care must be taken to prevent concrete from drying too rapidly. Protect it from the sun, and keep it thoroughly wet. Portland cement needs plenty of water to ensure its proper and thorough setting. Sand for concrete should be reasonably coarse and clean. Fine sand, unmixed with coarse, should not be used. The coarser sand presents few surfaces, and is therefore better coated than the fine, and hence makes a stronger cement. On all masonry and concrete use the exact proportions which have been settled on. The coefficient of expansion of concrete and of steel is so nearly alike that there is no splitting apart of the two when the steel is embedded in cement. When cement is being used in large quantity, a sample amounting to 10 lb. should be taken from each car-load, a portion being removed from every fifth barrel, sealed, and labeled with the date and number of the car. These samples are to be kept in a dry place until that particular car-load has been used, and the concrete made from it has been placed and thoroughly set.

Detection of arsine in the air, according to Hebert and Heim, may be made by taking advantage of the well-known reaction with $HgCl_2$, but when a paper wetted with a solution of this salt is exposed to AsH_3 various other gases which possibly might be present may give a yellow tint which simulates that produced by AsH_3. It has been noted that passing the air through a solution of Cu_2Cl_2 will remove those interfering substances, and that if the air so purified is then passed through a U tube containing a slip of paper moistened with $HgCl_2$, the paper will not show a yellow tint unless AsH_3 be present.

FIRE AT THE HOMESTAKE MINE.

The importance of fire protection in mines where timber is used is evident on reviewing the expense and danger resulting from the conflagration at the Homestake mine, as described at length in the *Engineering News*, from which in part the following is taken, supplemented by additional data from a contributor. The workings are enormous, the amount of ore removed already having been about 200,000,000 cu. ft., and the length of underground track exceeds 50 miles. The entire workings are connected by many openings, which increase the danger of a general conflagration. The fire started at about 4 P. M. on March 25, 1907, as a result of ordinary blasting in old timbered workings, and the usual routine precautions were taken, the working place being visited after shooting. An hour later the fire was discovered, and immediately every effort was made to put it out. The air-pipes throughout the mine were arranged so as to be available for water in case of fire, but in the drift in which the fire occurred the pipes had not been laid. Hose and pipes were laid as soon as possible, but every effort failed to put out the fire.

An attempt was made to close all openings into the cross-cut and the foot-wall drift. The roof and sides of the cross-cut were boarded up tight with 1-in. boards and battens. In closing a tunnel the usual method was to stand 3 by 4-in. uprights, with 1-in. boards nailed on both sides, the space between being filled with wet clay. A cheaper and quicker method used in some places was to nail the boards on one side only in the manner of lap-siding upside down, the ledge formed by the lap being daubed with clay to make the joint air-tight.

As the air in the shaft was charged with a considerable percentage of gas, an air-lock was built near the 500-ft. station, in which the men could stop for a few minutes on the way to and from the fire. This lock was made by closing a part of the drift with doors, the air inside being kept pure by the admission of compressed air. A man was stationed in this lock whose duty it was to issue a check to each man as he passed through the lock on the way to the fire, and to see that all checks were returned when the relay returned. In this way it was almost impossible for a man overcome by gas to be left behind without being missed in time to be safely rescued.

After the pipe-lines were finished an attempt was made to get at close quarters with the fire. The two men at the nozzle were provided with leather helmets, which were fed with compressed air from the air main through a small hose. These helmets were made by the company's harness-maker, and fitted up at the machine shop. With these the men succeeded in getting close to the fire, and were doing effective work when the cross-cut began to cave behind them and they were forced to retreat. Soon after this the cross-cut became completely filled, so that a part of the fire was entirely shut off from further access. The caving of this cross-cut was no doubt caused by the fire burning out some of the timbers of the stope below, so that the water caused the fill to settle. It

was accordingly decided to close all the openings around the fire and endeavor to smother the fire with steam, and water was also turned into the open-cut above the fire in the hope that some of it would reach the burning timbers. After 7½ days an opening was made and two drifts were started in the broken ground surrounding the fire-area. These were driven until they reached rock which was highly heated, large masses being actually red-hot. As tests of the air in various parts of the mine showed continual increase of carbonic acid, indicating that combustion was still going on, it was finally decided to flood the mine. All the stations were boarded up to keep out floating timber which would interfere with the skips in hoisting water. All the water available in the company's system was turned into the mine, through shafts or the open-cut, and the water of Whitewood creek was brought in by a specially constructed flume emptying into the Savage tunnel at the 300-ft. level. The time required to fill the mine to the 225-ft. level was nearly 40 days, and it is estimated the space filled was 80,000,000 cu. ft. The unwatering of the mine was effected by skips, air-lifts, and Cornish pumps, an average of 10,000,000 gal. per day being maintained. When the air-lifts were taken out of commission, the high-pressure line was lifting water 336 ft. with a submergence of 171 ft., and the low-pressure line was working against the same head with a submergence of 135 ft., the two together raising about 600 gal. per min. These pumps were made by lowering two 8-in. pipes from the 300 to the 800-ft. level in the pipe compartment, and a 2-in. air-pipe was put inside each 8-in. pipe, extending down about 240 ft. below the discharge. The 8-in. pipes had a conical end at the bottom, provided with 2-in. holes in the cone-surface, the combined area of holes being 2½ times the area of the pipe cross-sections. On the lower end of the 2-in. pipes were pieces of pipe about 8 in. long with numerous small holes in the circumference, pointing upward at 45°, the ends of the pipes being closed with a cap. The discharge ends of the water columns were provided with special curved elbows, having flanged openings through which the air-pipes entered. Two skips of 2000-gal. capacity each were used in bailing. The air-lifts and skips discharged at the 300-ft. level. At the beginning of September the water was down to the normal level, being about six months after the outbreak. The mine workings and machinery were found practically undamaged by the flooding, except for the deposition of a little mud, and no human life was lost.

A good system of water-pipes maintained throughout the mine is the best protection from fire, and in special cases, where peculiar danger of fire occurs, it is often advisable to arrange the workings in separate fire districts which can be shut off by the closing of a few openings and the fire thus isolated. The great expense and difficulty of subduing mine fires only emphasizes the necessity for precaution. It may be added that only the older workings of the Homestake mine contain large quantities of timber in square sets and bulkheads. The system of stoping at present employed almost entirely dispenses with timbering, except on sill-floors and in chutes.

CYANIDE CORRESPONDENCE.

[The following is a letter from G. L. Guthrie, at San Juancito, Honduras, to Charles Butters, at San Francisco, handed to us by the latter. It has been deemed best to publish it in its original form, on account of its interest to those engaged in cyanidation.—EDITOR.]

Today I have turned over the completed cyanide plant, with all its connections at the mill and elsewhere in perfect running order, to the company. I take great pleasure in informing you that my year's work and worry has resulted in a plant successful in every detail.

The average daily extraction has been 88.29% silver, 91.87% gold, 90.19% total extraction.

Heads have averaged	38.623	oz.	silver,	1.087	oz. gold.
Filter residues	4.522	"	"	0.0844	" "

The filter takes on a fine cake, holds it, cracks very little, does not peel, washes perfectly, and discharges the residues cleanly. It will handle (although only 58 leaves are used) up to 25 tons, although I only put on 12 to 15 tons. Even with 45 minutes of solution and 20 minutes of water washes, it only takes 2 hr. 20 min. total time of operation per charge.

You remember the filter was sent down with a very shallow bottom and end doors were arranged so that the residue could be sluiced out. It washes chiefly by gravity and the 6-in. pump only runs 24 minutes per charge.

Mr. Patterson was given to understand that they could not excavate lower down and he designed the filter accordingly. It did not appeal to me to have to lose so much time cleaning out residue, so I put in pointed discharges and arranged a system of water pipes, so that by opening one valve eight small streams of water dislodged the slime, the result being that the filter discharges cleaner and quicker than either the Devisadero or Copala filters.

The lower slide-bolts fastened to each end of each filter-mat makes it very simple to remove the mats for acid treatment, and the water-glasses in the suction-hose show just how each mat is working. The filter has run nearly three months and I have not had to repair a single mat. The discharge is clear, and I have never had enough trouble with receiving-vats, gold-vats, or sand-filter to make it worth mentioning.

The vats, pumps, valves, and friction-clutch lever are so arranged that a cheap native runs the filter per shift, hardly leaving the filter-platform. I honestly believe it is the simplest run filter installed up to date. Certainly, 90.19% extraction, as compared to 75% under the old system, shows up very well, especially considering the new plant has only been running 11 days. I have cut expenses all to pieces, and I feel sure that if the plant is run properly, the company will never regret the change. A competent force is broken in, the work and treatment systematized, and Mr. Schram, my successor, is a very capable man, so I consider that I have turned the plant over in first-class condition. It has taken a longer time than I expected, principally because the company delayed ordering the things that I deemed necessary, lumber was slow in coming in, and the con-

struction force at my disposal, especially mechanics, has never been adequate, except the masons.

The plant was built principally on a slime-dump in a gulch, and I have had to weave in the new plant with the old. The same at the mill, without shutting either down but a few days, and I have had to use a lot of the old material. The entire responsibility of laying out all constructional and mechanical work, besides the metallurgical end of it, has been up to me. This letter is not meant to throw bouquets at myself or tell 'a hard-luck story,' but just a statement of what the work has been.

I have made some mistakes but have rectified them in time. A masonry sump built on a slime-dump cracked and had to be repaired. I had trouble at first with the Gould pump and had to re-adjust some launders. The Meese & Gottfried engineers claimed that my power-transmission was weak at the agitator end, but this was not proved, for I ran the first five agitators over two months without even tightening the new rubber belt that drove them or having any mechanical parts run warm, but of course I am glad to have the heavier gears in. I have installed seven large and one small mechanical agitator and two hand-power stirrers of the slime-collecting vats; built a 200-ton and a 400-ton masonry vat; built new or re-built 13 wooden vats ranging from 18 to 26 ft. by 11 ft. deep; set up 14 pumps from 3 to 6 in. and one compressor; outfitted the zinc-room into quite a neat efficient extractor-house with its 11 wooden boxes of six compartments, each cock-compartment 18 by 18 by 22 in., 40-frame press, 5-hp. motor, pressure-pump, and 4 by 12 ft. precipitate-dryer.

Luckily the boxes were made, but not connected up. The carpentry and masonry work, on account of the rotten condition of the red plant, the new addition to the red zinc-room, and the soft condition of the ground, has been very great. I have had to use all the tact and diplomacy I could muster to keep peace with all the employees and get work turned out, and I believe every employee of the company feels friendly toward me.

The following is an outline of the ore and treatment as at present: The total product of the 45-stamp mill (850 lb. per stamp) is treated as slime, there being between 15 and 17% fine sand in the slime, which will not pass 200 mesh, and in fact the slime itself is practically all fine sand. The ore is very hard quartz. The sulphide and oxidized ore are mixed for crushing.

There is about 2½% of concentrate in the ore and a good deal of copper and iron, some lead, zinc, and antimony, and a lot of free coarse gold and silver. The ore is crushed through 30 mesh with 3 in. discharge, 99 drops per minute and a dilution of 6 to 1, crushing in solution. The pulp is pumped to classifiers, the slime overflowing to two 18 by 11 ft. slime-collecting vats with hand-power agitators in order to regulate the specific gravity of the slime drawn out for treatment. The overflow is clear and flows to a 16 by 11 ft. mill-solution vat and from there pumped back, a rise of 54 ft., to a 200-ton masonry mill-feed vat. The oversizes flow to the two 3½ by 16 ft. Smidth Pettle mills and there the discharge is re-classified.

The slime from the collectors flows by gravity to a centrifugal pump, which either pumps it to five old amalgamation pans or to three separator-pans for a preliminary treatment in order to get the proper dilution and to make up the proper strength of solution, or directly to an open launder connected to the same pans, where it flows 200 yards to two 26 by 11 ft. combination collection and treatment-vats, where regular treatment takes place with agitators and pumps, the solution being kept up to strength. Charges of 40 tons dry slime are drawn from these vats and transferred in rotation to the six regular 20 by 10 ft. treatment-vats, four of which have agitators and two conical bottoms for pump agitation. In rotation the charges are treated, settled, decanted, and transferred to the 22 by 11 ft. filter-feed vat and from there falls by gravity to the filter.

The solution from the filter passes to the two 20 by 10 ft. receiving-vats and on account of the site is pumped to a 20 by 10 ft. settling-vat and then by gravity to two 12 by 4 ft. sand-filters and from them to the zinc-boxes.

Treatment lasts about 90 hours, but the slime is actually in contact with the solution over 100 hours. The strength of the solution is kept up to about 0.6% KCy, 0.13% CaO, and 1.6 lb. lead acetate is added per ton of dry ore at beginning of actual treatment. Dilution during treatment is a little over 2 to 1. The zinc-box heads assay between $6 and $8; the tails a few cents. Lime is added principally in the ore-bin, and some in the pans at the preliminary treatment. On account of this being the dry season, we are short of power at the power-house, and consequently I can give very little aeration into the circulation pumps. Between 84 and 88 tons are treated per day. With another tube-mill the plant would easily handle 110 to 120 tons of slime, and with a small sand-plant it would take care of 150 tons.

As soon as things are better arranged and a better line gotten on the treatment, they should be able to cut down the strength of the cyanide alkali, and especially the lead acetate. I have made a good many experimental runs, which have been proved by actual results in treatment. On account of necessary repairs at the mill I was able to make the change over to cyaniding, only shutting down the mill for two days. During all construction the old plant was only shut down for what was equal to eight or nine days time and the new improvements put in from time to time more than increased the output to equal the time lost. They made me so mad a number of times that I felt like throwing things. They seemed to think I could put a pulley on a line-shaft without stopping it, and they seemed to think more about not shutting down the little old plant than they did about getting the new one built.

I forgot to state that a 75-hp. motor runs the plant proper, a 35-hp. motor the filter-apparatus, and a 5-hp. motor the zinc-room machinery. Water-power runs the mill.

MINING CONDITIONS ON THE RAND.

By Thomas H. Leggett.

*In a paper† presented to this Institute in August, 1900, I drew attention to the great cost of sinking the very deep vertical shafts that were then being seriously proposed as necessary for the development of the deeper areas, pointing out the strong advisability of working this ground by means of inclines from the existing shafts, then from 3000 to 4000 ft. vertical. In this paper it is stated that practice upon the Rand tended toward fewer vertical shafts and more underground inclines, especially for the very deep mining about to be undertaken at that time. But the 6000-ft. vertical shafts, at one time so much discussed, have never been started, nor are they likely to be.

The necessity of placing all deep shafts farther apart, in order to make them control and exhaust larger areas, was also dwelt upon. This economy was vitally necessary for both financial and technical reasons, few of the deep shafts being operated to anywhere near their full efficiency, and to further this object the advisability of consolidating many of the deep-level companies was pointed out.

The hard times that the Rand has been going through during the past few years have emphasized these points, with the result that the very deep vertical shafts are no longer suggested, while the amalgamation of a large number of the deep-level properties has already been consummated and other amalgamations are under way.

There were many deep-level companies formed 8 or 10 years ago with areas of from 200 to 300 claims (from 280 to 420 acres), which were to be developed by means of vertical shafts placed about 2000 ft. apart. Many of these properties have been consolidated, so that the areas are now multiplied two or three times, while the distance between shafts has been increased from 3000 to 4000 ft. In some instances, properties of large area are being opened up by a single deep shaft, which is permissible where connections can be made with adjoining properties, so as to give the two exits required by the Transvaal law.

Under these conditions, several years ago I started a single seven-compartment shaft to be sunk approximately 4000 ft. to develop a property of 254 claims (about 356 acres), each of the six hoisting compartments being 5 by 6 ft. inside of timbers, and the pump and ladder way 6 by 6.5 ft., and as stated, several similar single shafts have since been started. In short, economy in all directions is the order of the day, and necessarily so, since new capital is not easily found for defraying the cost of expensive deep-level development.

Consolidation of Properties.—An excellent instance of the merging of deep-level properties is the consolidation of the Knights Central with the South Knights. The Knights Central has an area of 444 claims (622 acres), a capital of £525,000, and is developed by means of two 5-compartment shafts, about 2000 ft. apart, and each about 2200 ft. deep. This company today has 282,000 tons of ore developed, assaying about 8 dwt. over an average width of 4 ft., which is highly payable ore, but it has only about £50,000 cash in hand, or not nearly enough to build the necessary 200-stamp mill and cyanide plant and to develop the mine adequately. The South Knights property has an area of about 450 claims on the dip of the Knights Central reef or adjoining that property on the south, where its shallowest depth of reef is about 5000 ft., and it has a paid up working capital of about £300,000 cash in hand. This amount of money is quite inadequate for the necessary shaft sinking, equipment, and development, to say nothing of the necessary milling plant. At the present unfavorable period it would be impossible to raise additional capital, as is evidenced by the fact that not a sod has been turned upon the property, although the company has had nearly $1,500,000 cash in hand since its formation several years ago.

The consolidation of these two properties gives an area of 894 claims (1250 acres), insures a long life to the enterprise, and furnishes the necessary funds for bringing the property to a producing stage, since the cash in hand will then amount to £350,000. It also puts the shareholders of the deeper property within measurable distance (probably 12 or 15 months) of receiving a return upon an investment which has already lain fallow for five years, and which, could they succeed in raising the additional capital necessary to bring it to fruition, would still require six or seven years more.

This example is a fair type of the consolidations recently accomplished and still going on, chiefly between the mines forming the second row of deep-levels (average depth of reef about 2600 ft.) and the deeper ground beyond, although in some few instances amalgamations of deep ground with the nearest outcrop companies are also being discussed. These combinations are in almost all cases advisable, from both technical and financial standpoints. The technical reasons were always fairly apparent, the financial are now evident.

Financial Conditions.—It is pertinent to touch upon the financial aspects of these consolidations, not only because the mining business, like all others, is governed by them, but also because one of the leading mining journals of the United States has published the statement that the mines of the Witwatersrand were greatly over-capitalized. I believe it is demonstrable that the majority of these companies are not over-capitalized.

In the consolidation of the two properties above mentioned, the Knights Central issued £375,000 fully paid £1 shares in payment to the South Knights for its entirely undeveloped property and its £300,000 in cash. The South Knights has a capital of £650,000 (in £1 shares), of which but £500,000 are issued, including 150,000 shares working capital guaranteed at 35s., this latter feature being the cause of the present large amount of cash in hand. It is evident that the deeper property suffers a large shrinkage of valuation by this consolidation; it is almost invariably the case that the company owning the deeper

* Abstract from Bi-monthly Bulletin of the American Institute of Mining Engineers, May 1908.
† *Transactions*, A. I. M. E., Vol. XXX, pp. 947 to 987.

and generally largely undeveloped property has thus to suffer in these amalgamations.

With respect to this very deep ground, the engineer earliest on the Rand, Hennen Jennings, was always very cautious, while John Hays Hammond uttered a note of warning in 1901, with which all conservative engineers on the Rand agreed, when he said:* "The results of the developments in the deep-level areas have been so satisfactory as to engender a certain recklessness on the part of mining companies owning very deep reefs. The exploitation of certain of these areas is not regarded by conservative engineers as at present justified, in view of the large intervening tracts of undetermined value which separate mines in operation from the site of proposed mining upon these very deep-level areas."

The redeeming feature of the formation of companies on these deeper areas was the invariable provision of a good round sum for working capital, as in the case of the South Knights, and such was the faith of the issuing house in the value of these properties that this working capital was guaranteed at prices usually much above par. The result has been, however, that by far the major part of this working capital has had to be paid by the guarantors (not a pleasant position when the same shares can be bought today for one-fourth to one-sixth of the guaranteed price), and this liability can never be avoided, not even by the liquidation of the company.

It speaks well for the character of Rand finance that none of these deep-levels was floated without this provision of immediate working capital and in large sums. The consequence is that the deeper companies are in the position to make much better terms when combining with their northern neighbors than otherwise would be the case, while to this consolidation many of them must inevitably come, for the reasons already given.

With reference to the alleged over-capitalization of the Witwatersrand companies, a record of the dividends paid by 47 of them (all the data now available) for the year 1907 shows an average of 44% on the aggregate capital, while certain properties did much better, as, for instance, the Crown Reef, 210, and the Ferriera, 300%. The Rand Mines, comprising a group of nine producing deep-level mines, paid 130% in dividends during 1907, and promises to increase this rate during 1908. According to Ross E. Browne, the total expenditure in shafts, development, plant, and equipment by these nine companies before reaching the producing stage averaged £620,000 per company; consequently a large capitalization is warranted. The report of the Mines Department of the Transvaal for November, 1907, shows 71 mines with mills in operation on the Rand; hence it is evident from the foregoing that the majority of these mining companies are far from being over-capitalized. It is undoubtedly true that the stock market has over-capitalized these companies several times, and probably this fact has led to a confusion of ideas on this subject. Doubtless some of the deep-level mines, more especially the developing ones, today seem to be over-capitalized, but they did not so appear at the time of their flotation, else the working capital would never have been so cheerfully guaranteed at a high premium. Moreover, it is far from certain that they will be so regarded a few years from now, when further development and improved economic conditions bring their welcome changes.

A Typical Scene on the Rand.

About five years ago I examined a developing deep-level mine that showed only 40% of 500,000 tons of ore in reserve to be payable. Today this property is

*"Gold Mining in the Transvaal, South Africa," *Trans.* A. I. M. E., Vol. XXXI, p. 852.

making profits of £60,000 per annum and steadily improving, while it is unquestionably crushing much of the ore that five years ago was unpayable.

Working Costs.—As a mining district grows older the working costs almost invariably decrease, provided the district maintains a healthful activity with advancing years, and this has been the case on the Witwatersrand, the result being as follows:

1898, average working costs of 65 companies..25s. 1.3d.
1899, average working costs of 42[1] companies..25s. 2.7d.
1906, average working costs of 58 companies..22s. 1.0d.
1907, average working costs of 56[2] companies..20s. 8.0d.

[1]The Boer war broke out in October, hence the records are incomplete.

[2]Two less than in 1906, due to exhaustion of the Bonanza mine and incomplete records from one other mine.

These costs include mining, development, crushing, sorting, milling, cyaniding, maintenance, and general expenses, but they do not cover depreciation and amortization, these items being more properly apportioned by the directors at the end of the year. These results show the important decrease of 4s. 6d. per ton since 1899, and are therefore approaching now to the 6s. reduction predicted by Mr. Hammond in 1901, but it has taken time to attain this result, as I then pointed out it would do. A comparison of the costs in 1907 with those of 1906 shows a decrease of 1s. 5d., or 34 cents, per ton, due chiefly to decreased wages and increased efficiency of both white and colored labor, including the Chinese in the latter category, though increased crushing capacity through the use of heavier stamps (up to 1670 lb. per stamp) and re-grinding in tube-mills have also aided.

In 1906, 58 companies mined and milled 13,065,624 tons of ore, at a total cost of £14,411,219, while in 1907, 56 companies mined and milled 14,861,234 tons, at a total cost of £15,351,749, being an increase of 1,795,610 tons for an increased cost of only £940,530. Most of these economies were attained during the latter half of 1907, after the strike of white miners, and some mines made startling reductions, as, for instance, the Robinson, which reported costs of 14s. 9d. for November, and the Glencairn, of 15s. 1d. per ton.

Such strenuous and successful efforts are now being made to reduce still more the working costs on the Rand that I think it safe to anticipate another large decrease for the year 1908.

Output and Dividends.—The total output of the Witwatersrand district for 1907 was 6,220,227 oz. (213.27 tons) of fine gold, equal to an average of 17.75 tons of gold per month. The present yield exceeds 19 tons of gold per month. The value of the output is approximately £26,436,000 ($128,572,000), an average of $10,714,300 per month for the year. This amount does not include the 'outside' districts of the Transvaal, which are producing in addition about 20,000 oz. per month.

The returns available to date from 56 companies show a total yield during 1907 of £25,154,591, which is equal to 33s. 10.2d. per ton, and a total profit of £9,805,906, equal to 13s. 2.3d. per ton. The yield per ton for the entire district is practically 34s., or $8.25, which is about 6s., or about $1.50, less than the average return of 10 years ago. On the other hand, working costs have been reduced 4s. 6d., and are still decreasing, while nearly three times the amount of ore is being crushed as in 1897, although the number of producing companies has not been increased 25 per cent. The number of stamps, however, has been more than doubled. 3567 stamps in 1897 and 8375 stamps in November, 1907. Small companies have dropped out and larger ones, both outcrop and deep-level, have taken their places, while many outcrop companies have greatly increased their crushing capacity.

The dividends for 1907, declared up to January 1, 1908, amount to £6,937,187, or £1,202,026 in excess of the dividends for 1906, and these amounts are exclusive of the 10% profit tax, from which the Transvaal Government should derive an income for 1907 of about £760,000. These dividends represent slightly more than 25% of the gross output of gold from this district for the past year, certainly an excellent record for any mining district.

In the paper entitled 'An Estimate of the Gold Production and Life of the Main Reef Series, Witwatersrand, Down to 6000 Feet,'‡ Frederick H. Hatch and I predicted an ultimate annual yield of £30,000,000. The yield is now within 12% of that estimate, which it bids fair soon to reach. The output for the entire Transvaal for 1907 was £27,403,738, an increase of £2,823,741 as compared with 1906; practically all this increase was due to the Rand proper.

Labor.—There is one important point that does not seem to be generally understood, namely, the introduction of the Chinese into the Transvaal is not on a par with their introduction into Canada, Australia, the United States, or any of the countries that object to their presence. In these countries the Chinaman comes immediately into competition with white labor, while in the Transvaal he does not, because there already exist there two planes of labor, the white and the black, and the Chinaman has been rigorously confined to the latter.

In any country where white and black labor work side by side, there are always certain things the white laborer considers *infra dig.*, and he will always relegate these to the black. The white man is always scrupulously careful to keep the black on the lower level, and to not allow him to rise, since that would mean competition. In the Transvaal the white miner has the overseer's position and the black man does most of the hard work. Engine-drivers and mechanics are white men; in fact, skilled work of all kinds has always been done by the white man, and always will be done by him. The Chinese have simply supplemented the supply of Kaffirs, and have never been in competition with the white labor any more than are the 100,000 or more Kaffirs now at work in the mines in such competition. Nobody has ever objected to these Kaffirs working with, and under the direction of, the white miners, and as there are 6,000,000 of them south of the Zambesi alone, the country can never be made a 'white man's country' in the full sense of that term.

It is evident that the feeling against the Chinese, founded as it is upon a valid and practical cause in

‡ *Transactions* Institution Mining & Metallurgy, Vol. XII, p. 44.

other countries, has no such basis in the Transvaal, and is there but an empty sentiment; one, however, that was worked to such an extent in England, where the average man knew nothing of the real conditions and supposed the Chinese would eventually oust the Briton, that the former have to be sent home on the expiration of their contracts. This has been going on for some time, so that out of the 53,000 Chinese in the country at the end of 1906, it is estimated that but comparatively few will remain by the end of this year.

The repatriation of the Chinese is a loss to the mining industry of the Rand, since they are more intelligent than the Kaffirs and have become adept at mining work. Moreover, they are on a three-year contract, while the Kaffirs seldom stay for more than six months at a time, though they often return.

The question now is, can all the Chinese be promptly replaced by Kaffirs, to whose scarcity after the war the introduction of the coolie was due? On this point divers opinions have been expressed, but thus far they have been replaced, in the month of November, 1907, no less than 4610 Chinese having been sent away and their places filled by Kaffirs. The Transvaal Government, acknowledging its responsibility for sending away the Chinese, has put itself on record as desirous of aiding the mining industry in every way in its power to secure Kaffirs, and as they have perhaps more ways of doing this, it seems highly probable they will succeed.

As to white labor, the miners' wages, heretofore excessive, have been reduced, partly due to the necessity of giving work to the hundreds of unemployed in and around Johannesburg, with a resultant benefit to all concerned, since the efficiency of this class of labor has been much improved. Before the strike the white miners' pay was £1 per fathom stoped, based on the work of the poorest miner, with the result that capable contractors made enormous profits; today contract prices are reduced, and, what is still more essential, are based upon the capacity of the best miners.

Annual and Quarterly Reports.—The mining companies on the Witwatersrand publish such full and complete reports of their operations that they can well serve as a model in this respect to the rest of the world. They comprise reports of the board of directors, the consulting engineer, and the manager, and give very full and complete tables, showing the technical details, costs, and results of the operations, together with full financial particulars, comprising usually a balance sheet, revenue and expenditure, or profit and loss account, and an appropriation account; but above all they show the tonnage available at the end of the year, and its value, and describe the mine development and the appearance of the bottom levels of the mine.

The quarterly reports issued regularly to the shareholders give the results of the preceding three months' work, yield, costs, and profit, together with a short description of the appearance of the mine, latest developments, tonnage of ore blocked out, and often its assay-value. Many mining companies in London now send monthly postal cards to each stockholder giving the amount of ore treated, the yield, cost, and profit for the preceding month, and any important feature of the month's development.

In this day of reform in corporate management it is to be hoped that many of the American mines, well managed in all other respects, will copy the methods and practice of the English companies.

Outlook.—With regard to the outlook for the mining industry, it is several years since I was in Johannesburg, and it is therefore appropriate to quote the views of those who have more recently visited these goldfields.

W. Fischer Wilkinson says:* "There is still a considerable margin between the average working costs and the average recovery [average recovery $8.25, average costs $5 per ton.—T. H. L.], and a still further lowering of the grade may be expected, carrying with it a corresponding increase in the tonnage available for profitable mining. Low-grade ores of a value of 5 dwt. per ton or so, which were formerly considered worthless or of little value, are now becoming a valuable asset, and the prospective lives of the working mines are constantly having to be re-estimated to meet the altered conditions. Undeveloped properties or those partially developed, whose prospects with costs at 30s. per ton or thereabouts were not bright, can look forward to a profitable existence now that costs have been in many cases reduced to 20s. or less. The possibility of working low-grade ores profitably has now been amply demonstrated, and there is no danger of the Transvaal's failing to contribute heavily to the world's supply of gold for many years after the exhaustion of the richer mines of the Central Rand."

Evidence given before the Mining Commission in Johannesburg during 1907 was to the effect that 39 of the dividend-paying companies had an average life of 12 years and 8 months. Since the life of every mine exhausted to date has been greatly under-estimated, sometimes by as much as 50%, and since much lower grade ore will eventually be worked than is at present milled, it is safe to say that the average life of the above 39 properties will be at least 15 to 16 years. It would be interesting to have the estimated average life of a greater number of the properties; but as there were 71 mines that dropped stamps in November, 1907, of which about 50 are paying dividends, and as more deep-level mines will soon join the ranks of the producers, it seems reasonable to expect not only a maintenance of the present output for some years, but even an increase up to £30,000,000 per annum for a part of that time.

As regards development in the deep-level mines, upon which so much depends, although high-grade ore, assaying in the ounces, was struck in the Cinderella Deep at a vertical depth of 4000 ft., and while the Knights Central (still developing) has large quantities of 8-dwt. ore at a vertical depth of about 2400 ft., I am informed that other mines show long stretches of 5 and 4 dwt. ore, with only occasional high-grade stuff. It is therefore imperative that costs should be reduced still further, in the near future, before these deep-level mines reach the pro-

* *Engineering & Mining Journal*, Vol. LXXXV, p. 53.

ducing stage; and in this connection it is interesting to note that Mr. Browne, who has recently made a two-year study of the conditions on the Rand, states that if the white and the Kaffir labor were made more efficient, which he believes can be done, and the cost of supplies lessened, costs could then be reduced to 15s. per ton. This is a most encouraging statement, coming as it does from a specialist in the subject, and made at a time when the working costs were 22s. per ton.

There is no doubt that costs will be reduced below 20s. during the present year, probably to 19s., perhaps even better than this, for higher efficiency of both white and black labor is now the earnest objective of all the mine managements, and when one reflects that these two items comprise about 62% of the total costs it is evident what an effect the greater efficiency of labor will have. It is also to be noted that as the efficiency of the miner increases the cost of supplies decreases; he consumes less or makes a given quantity go further.

Improvements in the metallurgical practice have brought the extraction up until it is now about 95% of the assay value of the ore, an important matter when one considers that the saving of one grain of gold per ton of ore crushed means, at the present scale of operations on the Rand, an increased yield of $600,000 per annum. Finally, Mr. Wilkinson considers 5-dwt. ore to be now a valuable asset in any Rand mine—all of which goes to show how time is working in favor of all the mines on the Rand, and especially the deep levels.

In more than one deep-level mine the stopes have turned out better than the assay-plans have indicated, and when one reflects that the drifts are now from 200 to 300 ft. apart (even 400 ft. in some deep-level mines), and the connecting winzes separated by distances of 400 ft. or more, it is evident how this may happen. Again, later development has shown that poor zones occur in more or less horizontal stretches, so that the bottom levels of a mine may all be in poor ore at the same time, but on pushing down through this zone the development has again disclosed the normal grade of reef.

Hence it is now thoroughly well recognized on the Rand that deep-level mines must have from 5 to 10 miles of intelligently directed development work on the reefs themselves before a valid opinion can be formed of the value of a mine.

To summarize, we find that the Witwatersrand output has increased about £2,800,000 in 1907 as compared with 1906, while the dividends have increased £1,200,000, and working costs have decreased 1s. 5d. for the same period, with another heavy reduction practically assured during the present year. The use of tube-mills and of heavier stamps has increased the stamp-duty about one ton, until it is now 5.8 tons per stamp, while the extraction has been increased to about 95%; hence tailing that a few years ago ran about 1 dwt. or $1 per ton now assay but half that amount, with the result that lower grade ore can now be worked than ever before; in fact, one mine is actually in operation at present on a yield of only $4.31 per ton, or say 4.5-dwt. ore.

The possibility of a shortage of Kaffir labor by next July or August is to be considered, but this may easily prove to be not as serious as some now consider it. The Rand has been going through very depressing times, the natural reaction from over-speculation, with the result that everything is viewed there today "as through a glass, darkly." But the hard times have had a salutary effect; efforts are being concentrated along the proper lines to secure economy in all branches of its great gold-mining industry, and the results of these are bound to tell favorably in the near future.

The quality of water in the Great Lakes has been an object of investigation by the U. S. Geological Survey for the past year, comprising analyses of samples of water collected from various inflowing streams and also of the outflow from each of the lakes. These analyses show that except along shore at times of high wind the water in all the lakes is practically free from suspended matter of any kind. The water of Lake Superior contains the least amount of dissolved solids; that of the Lake Huron outlet, including water derived from Lakes Superior, Michigan, and Huron, ranks next. Lake Michigan is third, with about twice as much dissolved matter as Lake Superior. The outlets of Lakes Erie and Ontario are almost identical in quality. Lake Ontario is a trifle more highly mineralized than Lake Erie and contains two and a quarter times as much dissolved matter as Lake Superior water. The notable changes in composition passing eastward from Lakes Superior and Michigan are a gradual decrease in silica and carbonic acid and a gradual increase in chlorine and the sulphate radicle; calcium and magnesium increase and then decrease, while the alkalies decrease and then increase. Calcium, magnesium, and the carbonate radicle amount to about 80% of the dissolved matter. It is found that 3,350,000 lb. of dissolved mineral matter passes out of Lake Ontario each year. Of this quantity, 441,000 lb. comes from Lake Superior, 666,000 lb. from Lake Michigan, 913,000 lb. from Lake Huron, 840,000 lb. from Lake Erie, and 490,000 lb. from Lake Ontario.

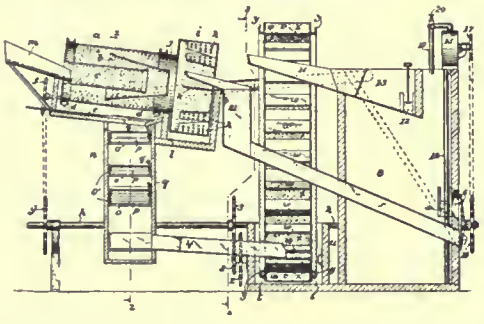
The old Port Royal mine of the Pittsburg Coal Co. is to be emptied of the water that has filled it for years. Three ten-inch holes are being drilled from the surface to the interior of the mine, a distance of 365 feet, and in each will be placed a six-inch pipe. Each of these pipes will be capable of discharging 2,000,000 gal. of water per day by the air-lift process, all of which will be emptied into the Youghiogheny river. When the drill penetrated the old workings the pressure of the gas threw the water as high as the derrick.

Chlorine is found in only three minerals in the igneous rocks, namely, apatite, sodalite, and the marialite molecule of the complex silicate known as scapolite or wernerite. The chief original chlorine-carrier is sodalite, containing 7.3%. The total chlorine in the original rocks is estimated as 0.01 per cent.

MINING AND METALLURGICAL PATENTS.

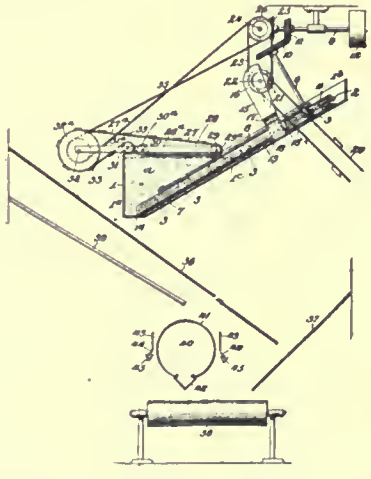
Specially Reported for the MINING AND SCIENTIFIC PRESS.

ORE-WASHING MACHINE.—No. 887,490. Hugo H. Meyer, Racine, Wisconsin.



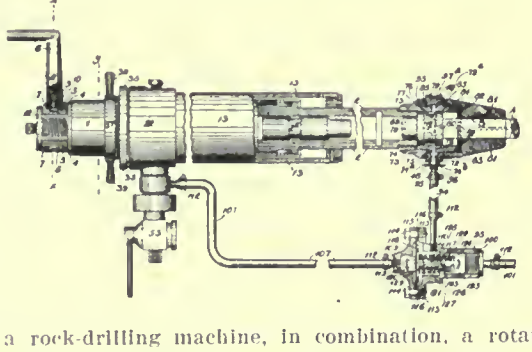
In an ore-washing machine the combination of a riffle-box containing a series of reversely inclined riffle-plates arranged one above another, a trough having a discharge opening at the bottom over the upper riffle-plate, a rotary screen mounted in said trough, an elevator wheel having a series of buckets around its rim, a trough containing the lower part of the elevator wheel, a conduit leading from the lower part of the riffle-box into the lower part of said wheel, a settling-tank, a chute extending from the upper interior part of said wheel to said tank, and a return conduit leading from the upper part of said tank into the screen trough, substantially as described.

AMALGAMATING APPARATUS.—No. 887,319. Fred D. Fenn, Boise, Idaho.



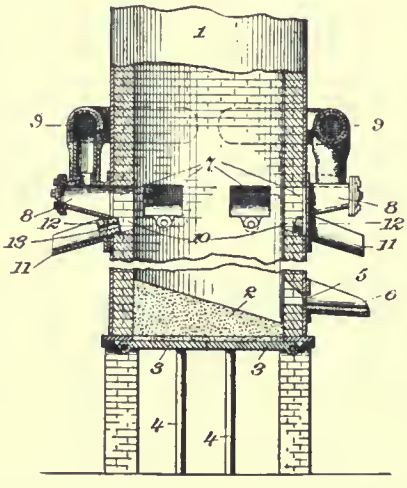
An amalgamating apparatus including a mercury tank, a chute having its lower end located therein, an endless conveyor located wholly within the tank and passed through the lower end of the chute, and a feed spout passed transversely through the chute and inclosing one run only of the conveyor, said spout opening into the chute and being extended to the bottom of the mercury contained in the tank.

ROCK-DRILLING MACHINE.—No. 887,801. Henry Hellman and Lewis C. Bayles, Johannesburg, Transvaal.



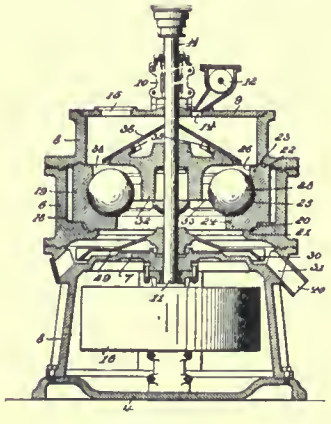
In a rock-drilling machine, in combination, a rotatable power-cylinder, means for rotating said cylinder, a reciprocal percussive member in the power-cylinder, a front head screwed to the cylinder, a swivel piece surrounding the front head, means for conducting water to said swivel, the front head having a passage placing the swivel in communication with a longitudinal hole in the bit, a nose-piece screwed to the front head and serving as a retaining device for the swivel, and a bit supported by and non-rotatable in the nose-piece.

METALLURGICAL FURNACE.—No. 887,777. William S. Dempsey, New York, New York.



In a furnace, the combination of a melting chamber having a series of openings formed in the walls thereof, a twyer box at each opening, each of said twyer boxes being provided with an air-valve and a slagging spout, and a removable plug partly closing the outlet through the slagging spout.

PULVERIZING OR GRINDING MILL.—No. 888,077. James W. Fuller, Jr., Catasauqua, Pennsylvania.



A pulverizing or grinding mill provided with a spider-frame having two series of supporting arms, a conical material distributing device supported by one series of said arms, pushers carried by the other series of said arms, a grinding ring supporting balls between said pushers, a sweeper, a shaft carrying said sweeper and spider-frame and actuating the same and means for removably connecting said conical device with said supporting arms, substantially as and for the purposes described.

PROCESS OF MAKING BARIUM OXIDE.—No. 886,607. Charles B. Jacobs, Port Chester, New York.

The process of reducing barium carbonate to barium oxide, which consists in suspending the carbonate in a finely divided condition in and throughout a uniformly porous reducing agent, and subjecting the same to heat to liberate the carbon dioxide, whereby the carbon dioxide is reduced to carbon monoxide and ready exit provided for the escape of the gas. The process of converting barium carbonate into barium oxide, which consists in suspending the carbonate in the form of fine particles throughout a uniformly porous mass of carbon, subjecting said mass to heat to decompose the barium carbonate.

MINE REPORTS.

DURBAN ROODEPOORT DEEP, LTD., TRANSVAAL.

The Durban Roodepoort Deep is the smallest producer among the subsidiary companies of the Rand Mines, Ltd., showing a net profit for 1907 of £41,073. The outlook for future operations has so improved through the opening up of the 'reef series' in the new shaft at a depth of 1460 ft., that the company's mill will be increased from 60 to 100 stamps, with the corresponding accessory equipment. The ore-reserves are given as 252,051 tons on the Main Reef, assaying 6.5 dwt., and 385,649 tons on the South Reef, assaying 7.8 dwt., making a total of 637,700 tons averaging 7.3 dwt. gold per ton. Development aggregating 11,416 ft. was done during the year, adding 395,458 tons to the reserves, the development cost per ton being 33.7c. Ore mined was 177,565 tons, waste sorted out 40,385 tons, net tonnage milled 137,180, having an average value per ton of 7.866 dwt. The 60 stamps dropped 330 days, giving a duty of 6.926 tons per diem. The recovery was 5.644 dwt. per ton, or 97.65%. Mill recovery was 71.75%, the cyanide operations adding 25.9%, of which 18.03% was extracted from sand and 5.61% from slime. Mining costs were $3.42, milling (including sorting and tramming) 85.3c., cyaniding 34.03c., tailing disposal 12.6c., making a total of $4.78. Total expenses, including development and administration, amounted to $6.82 per ton, against a revenue of $7.72, leaving a working profit of 90c. per ton.

CROWN DEEP, LTD., TRANSVAAL.

The Crown Deep, Ltd., is the best revenue-producer of the group of properties included in the consolidation known as the Rand Mines, Ltd. The net profits for the year 1907 amounted to £394,695. Dividends from the company's interest in the Robinson Central Deep, Ltd., added £59,189 to income, and from other sources, including balance brought forward, the available net sum of £547,281 is reached. The ore reserves are estimated at 1,323,253 tons, of which 703,788 tons are on the Main Reef and Main Reef Leader, and 619,465 on the South Reef. The development work for the year represented a footage advance of 11,030 ft., yielding additional proved ore-reserves of 552,236 tons, having an average assay value of 8.8 dwt. per ton. As the mill-capacity is practically 400,000 tons per annum it will be seen that the Crown Deep has a reserve supply blocked out three years ahead. Total mine costs amounted to the equivalent of $2.97 per ton, distributed as follows: developing 37.7c., stoping $1.413, shoveling and tramming 61.5c., hoisting 22.3c., pumping 10c., surface haulage 6c., general 20.2c. The development cost per ton of ore exposed by driving was 32.7c. A total of 437,036 tons was hoisted, of which 37,906 tons was sorted out as waste, assaying 0.807 dwt. per ton, leaving 399,130 tons milled, which carried 9.729 dwt. gold per ton, as deduced from actual bullion recovery plus assay value of mill tailing. The final tailing assayed 0.53 dwt. gold per ton, showing a recovery of 94.836%, which was slightly in excess of the theoretical extraction. The mill extraction was 65.597%, the cyanide sand extraction increased this by 22.551%, and slime extraction by 6.688%, making total cyanide recovery on original ore-value of 29.239%, the actual recoveries by cyanide being respectively 86.982 and 85.313%. The mill contains 200 stamps, which operated 322½ days, thus showing a duty of 6.183 tons per stamp per diem. The ore-treatment, or reduction, expenses were $1.106 per ton, made up as follows: ore-sorting 4.6c., crushing 4.6c., haulage 1.9c., stamp-milling 35.4c., tube-milling 13.1c., conveyance, classification of pulp and filling 5c., cyaniding 31.5c., disposal of tailing 13.2c. Total receipts were $9.29 per ton, total costs $5.42, and working profit $3.87 per ton.

OOREGUM GOLD MINING CO., MYSORE, INDIA.

The Ooregum Gold Mining Co., during the year 1907 treated in its 120-stamp mill 124,160 tons of ore, which yielded 64,084 oz. fine gold. Re treatment of 89,164 tons of tailing by the cyanide process produced 9068 oz. gold, and, with the addition of 410 oz. obtained in the dismantlement of the old No. 3 mill, the total bullion produced was 73,562 oz. The average yield was 0.5166 oz. gold per ton. The tailing produced 0.102 oz. per ton. The gold yielded a return of £278,898, from which a royalty of £13,827 was deducted, leaving net proceeds of £265,071. Miscellaneous receipts swelled the total to £267,888. As against this sum were expenses amounting to £173,433, so that the profit on the year's operation was £94,454. A portion of this was applied to the purchase of new equipment, and out of a balance of £40,922 dividends were declared at the rate of 17½% on preferred shares and 7½% on ordinary shares, amounting to £38,353. Dividends paid to date, since the first dividend, in April, 1891, reach the handsome total of £1,501,950, and the total receipts for the same period were £4,537,338. The issued capital is £300,041, on an authorized capital of £410,000.

Development work amounted to 18,394 ft., and the ore reserves at the end of the year were estimated at 143,988 tons, being a little more than one year's supply for the mill. The stock of tailing on hand amounts to 70,000 tons. The cyanide treatment showed a recovery of 67.5%, reducing the sand from an original gold tenor of 0.129 oz. to 0.042 oz., with a consumption of 0.63 lb. KCy, 0.68 lb. NaOH, and 0.12 lb. Zn per ton. Further milling details are not given. The Ooregum mine is one that is particularly subject to 'air blasts,' often involving great peril to the workmen.

CIA. LA UNION, PACHUCA, MEXICO.

The annual report of the directors of the Cia. Beneficiadora de Metales "La Union," for the year 1907, announces a decrease in the earnings due to four causes, imperfect work of the ball-mills, frequent demurrage of plant from interruption of the electric-power service, fall in the price of silver, and decline in the assay value of the ore. The use of the ball-mill presents a certain advantage in connection with the barrel amalgamation process employed, owing to the abrasion of iron from the balls, which supplies a necessary reagent in the chemical processes involved. But an excess of iron impedes the reactions, and increases the consumption of copper sulphate, and the ball-mills at this plant have contributed an enormous excess of iron to the pulp. The milling-cost with ball-mills has been ₱1.53 per ton, as against 80cv. with the Chilean mills working alongside. The tonnage crushed by ball-mills during the year having been 11,547, a saving of ₱17,666 would have been effected by using Chilean mills exclusively. Similarly, the company has made comparisons between the barrel-amalgamation and the cyanide methods of treatment, demonstrating that by amalgamation a recovery of ₱34.40 of the silver and ₱2.75 of the gold was regularly obtainable, while, in parallel, cyanidation yielded ₱30 of the silver and ₱4.50 of the gold, the total recovery standing at ₱37.15 and ₱34.50, in favor of barrel-amalgamation. But a comparison of costs shows ₱13 per ton by amalgamation against ₱8 by cyanidation, so that a net gain of ₱2.35 per ton would result from the introduction of the cyanide process. The company is accordingly making the necessary changes.

The affairs of the company are so prosperous that it expects to continue to meet these extraordinary expenses out of income without passing a dividend, if silver should fall no lower in price. The dividend distributed for the year has been ₱105,000, and there was expended on the installation of a cyanide plant ₱26,184, thus placing this property at the head of present producers at Pachuca, the next highest dividend-distribution by any mine in the district being ₱72,000. The total ore milled was 26,896 tons, which produced 28,055 kg. of fine silver, or 1.15 kg. silver per metric ton. The company had a contract with the Negociacion de San Rafael for the sale of its bullion, permitting settlement to be made at the election of "La Union," either on the Government exchange rate fixed monthly, or on the basis of New York silver quotations. The latter basis was chosen, resulting in a gain for the company over the returns that would have resulted by applying the Government rate.

DIRECT AIR-PRESSURE PUMPING.

During several months of the year 1907 an extended series of tests was made on a driven well near the plant of the Westinghouse Air Brake Co. at Wilmerding, Pa., to determine the amount of water raised, air required, and other necessary data relative to pumping by direct air-pressure. As wide a range of conditions as possible was covered in regard to different sizes of pipe and different combinations of 'lift' and 'submergence,' obtaining for each condition the most suitable and economical arrangement. The lift is the vertical distance from the water level in the well to the point at which the water is discharged. The submergence is the distance from the water-level down to the point in the well where air is admitted to the discharge pipe.

The well used is 174 ft. deep from the surface of the ground, has 6-in. casing, and the water-level is ordinarily from 16 to 20 ft. below the surface. An oil-well derrick was constructed over the well, with platforms at various heights to provide means for altering the lift. The air supply was obtained from a 1-in. connection to the air-system of the Westinghouse Air-Brake shops. The arrangement of piping, reservoirs, and so forth, is shown diagrammatically in Fig. 1. Two air-storage reservoirs, 30½ by 84 in., receive air from the supply source through a three-way cock, so that only one tank can be charged at a time. At the other end of these tanks, connection is made through a similar three-way cock to the line leading to the well. In this line was placed a 14 by 35-in. reservoir, a globe-

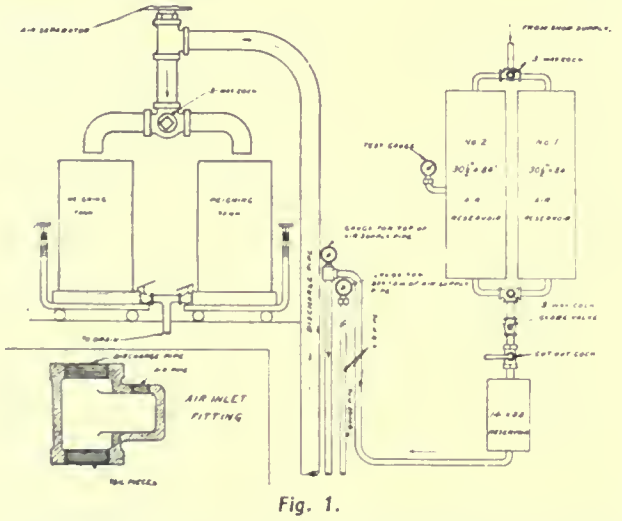


Fig. 1.

valve, and a cut-out cock. The shop air-system averages from 140 to 160 lb. pressure. Tank No. 2 was used for measuring the air in the tests, and tank No. 1 for starting the pumping operation.

Nearly 1800 tests were made, covering from 350 to 400 different combinations of discharge pipe, lift, and submergence. From t › figures obtained in these tests, curves were plotted, showing the variation of cubic feet of air used per gallon of water raised, and the gallons of water delivered per minute for the different ratios of lift to submergence. From these curves it was found that the cubic feet of air used per gallon of water raised, and the gallons of water delivered per minute, are practically the same for each ratio of lift to submergence for any submergence of a given size of discharge-pipe. For example, a lift of 10 ft. and a submergence of 20 ft. will take the same amount of air per gallon, or lift the same number of gallons per minute, as a lift of 100 ft. and a submergence of 200 ft., the size of discharge-pipe being the same. In both these cases the ratio is identical, while the submergence in the latter is ten times as great as that in the former. Consequently, it is only necessary to consider the ratio of lift to submergence and the size of discharge-pipe. It is also found that, for a given size of discharge-pipe the gallons of water raised per minute decrease as the ratio of lift to submergence increases. Also, the cubic feet of free air per gallon of water raised increase as the ratio increases for a given size of discharge-pipe, and, for a given ratio, the cubic feet raised decrease as the size of the discharge-pipe increases.

As regards the air-pressure required, it was found that the smallest pressure possible that would give a continuous flow from the well, was the proper pressure to use. It was found that, if the air-pressure was choked down slightly below this point the water would come out intermittently in spurts, and the air required per gallon was slightly less than the continuous flow, but the water delivered was considerably less. On the other hand, if the air-pressure was gradually increased above that just required to give a steady flow, the quantity of water delivered would increase somewhat, but the air per gallon increases in a greater

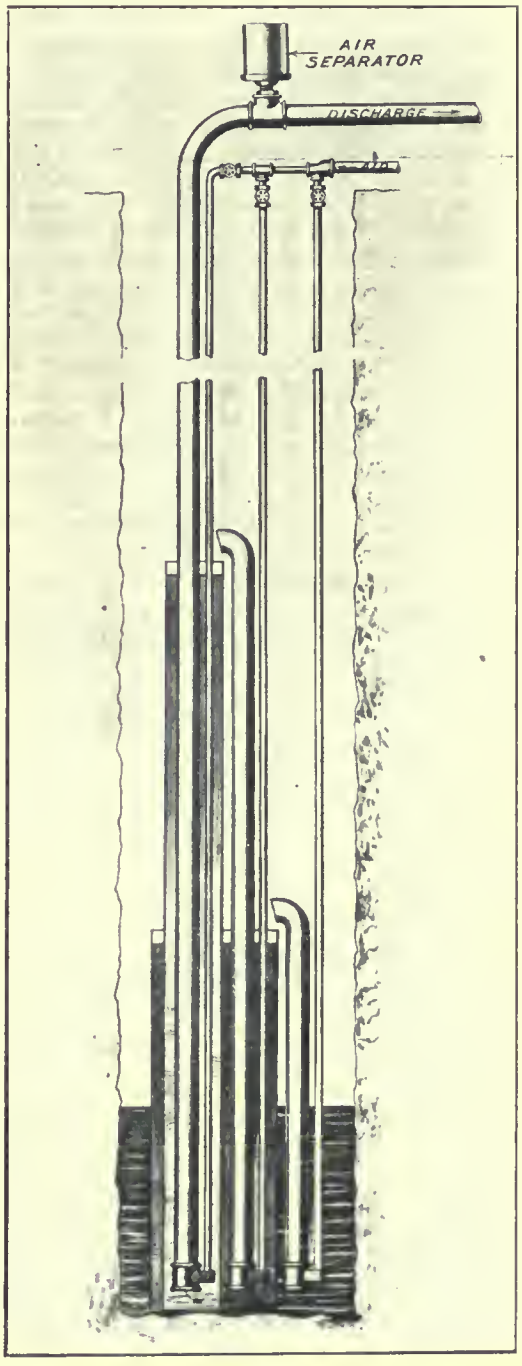


Fig. 2.

proportion, and as the air-pressure is further increased, the gain in the quantity of water delivered grows less, until at a certain point it stops, and from there on the water delivered decreases in amount. It is easy to regulate the air-supply by the sound of the discharge.

From the results obtained, it would appear that for a given lift the further down in the well the submergence is made the more economical the result would be. This is true as far as the well is concerned, but it must be considered that the greater the depth of the air-inlet, the greater the air-pressure must be, and consequently the more horsepower must be employed to compress the air. The quantity

of air required to operate the well decreases with the depth, while the horse-power required to compress a cubic foot of air increases as depth grows greater. A curve representing the horse-power per gallon of water raised for varying depths and constant lift will at first decrease as the depth increases, until it reaches a minimum, after which it increases.

The manner in which the operation occurs inside the well is as follows: As the compressed air enters the discharge-pipe at a pressure only slightly above the hydrostatic head, the column of water above is forced upward. Air continues to enter, filling up the space left by the rising body of water until the top of the water-column reaches the discharge opening. The moment that a portion of the rising water is discharged, the weight of the column is thereby reduced, and the air beneath it will correspondingly expand, thus reducing the pressure on the water in the discharge-pipe below the air-inlet. The weight of the water in the well, outside of the discharge-pipe, then forces the water upward into the pipe, stopping the inflow of air. The pressure in the air-supply pipe is quickly reinstated by its connection with the supply, so that it again forces an entrance into the discharge-pipe. This is repeated until the whole discharge pipe, above the air-inlet, is filled with alternate bodies of air and water, the combined weight of which is enough less than the water in the well to keep up a constant flow of water into the discharge-pipe. As each body of air rises, the total weight above it grows less, so that it continues to expand until, when it reaches the discharge, it issues at atmospheric pressure. In this way a continuous flow from the well is maintained as long as a sufficient quantity of air is supplied, and the capacity of the well is not over-taxed.

BOOKS RECEIVED.

TYPICAL STEEL RAILWAY BRIDGES. By W. Chase Thomson. Pp. 178. Ill. Engineering News Pub. Co., New York. 1908. For sale by the MINING AND SCIENTIFIC PRESS.

This book is exactly what its sub-title declares it to be, an elementary course for engineering students and draftsmen. It is particularly well adapted for such use. The designs of a number of the more common types of railroad bridges are worked out in detail, the treatment being such that a student with a working-knowledge of the strength of materials will be able to gain a comprehensive acquaintance with the leading features of bridge designing. The methods presented are thoroughly modern and according to approved practice. Five folding plates, illustrating the completed designs, add much to the usefulness of the book. This volume should be of especial value to the instructors who have not the time to prepare lectures themselves, or who do not care to use the more elaborate and lengthy treatises.

A POCKET HANDBOOK OF MINERALS. By G. Montague Butler. 8vo., pp. 298, insets and index. Ill. New York. John Wiley & Sons, 1908. Price $3. For sale by the MINING AND SCIENTIFIC PRESS.

The peculiar merit of this book is its size, admitting of being conveniently tucked in the pocket. Thus it can be made a companion in the field. It covers the more important mineral species with which the mining engineer has to deal, giving a sufficient description for identification. The minerals are arranged in accordance with the acid rather than with the base in the molecule, which has its advantages and also its manifest disadvantages in the absence of any means of tracing out all the minerals, let us say of copper or lead. There are tables for determination of species, atomic weights, and other useful information. The book is handsomely printed and bound.

A TEXT-BOOK OF ASSAYING. By C. and J. J. Beringer. 11th ed., pp. 456. London. Charles Griffin & Co. 1908. Price $3. For sale by the MINING AND SCIENTIFIC PRESS.

A TREATISE ON MINE SURVEYING. By Bennett H. Brough. 13th ed., pp. 372. London. Charles Griffin & Co. 1908. Price $2.50. For sale by the MINING AND SCIENTIFIC PRESS.

Brough's 'Surveying' is known to all students of mining, and has found a ready sale even in America, where numerous text-books on the same subject are available. This (the 13th) edition has been carefully revised, and contains descriptions of appliances invented since the publication of the 12th edition. Beringer's 'Assaying' is another of the well tried books on technology, and represents the authors' experience as teachers in the Camborne School of Mines, in Cornwall.

COMMERCIAL PARAGRAPHS.

O. P. CHERDON has resigned from Arthur Koppel Co., San Francisco, and leaves at once for the East and Europe. He expects to return within two months.

THE HENDRYX CYANIDE MACH. Co., Denver, has recently shipped a complete 100-ton cyanide plant to the Alvarado Gold Mining Co., Congress Jct., Arizona.

THE WESTERN LUBRICATING VALVE Co., Denver, has recently received an order for 300 Western lubricating valves, from the Homestake Mining Co., Lead, South Dakota.

THE COAST STATES CONSTRUCTION Co., San Francisco, has moved its office to the Hooker & Lent Bdg., Second and Market streets. George R. Devol will still be associated with Mr. Hopps on the engineering corps of this company.

THE ECLIPSE DRILL SHARPENING MACH. MFG. Co., Denver, have recently sold one of their machines to the Strong mine, Victor, Colo.; one to the Golden Cycle mine, Independence, Colo., and one to the Bunker Hill & Sullivan mine, Wardner, Idaho.

JAMES S. WATSON, manager of the drive chain department of the LINK BELT Co., has transferred his headquarters from the Philadelphia works to the company's chain manufacturing plant at Indianapolis, where he will combine supervision of manufacture with direction of the selling force.

THE HENDRIE & BOLTHOFF MFG. & SUPPLY Co., Denver, has issued its regular monthly announcement for June. It describes a number of specialties lately introduced, among them being waterproof leather belts, a new form of belt lacing, a washer and gasket cutter, and a combination pocket tool for miners. Special circulars describing each of these will be sent to any address.

THE RANSOME CONCRETE MACHINERY Co. has recently put on the market a device which combines a concrete barrow and mixer. The essential feature is a frame into which the the ordinary two-wheeled concrete cart is placed so that it may be revolved about the axle of the cart, the wheels serving as journals. The frame is provided with a cover which clamps on the cart, closing it tightly, and blades in the cart body secure more efficient mixing. The mixer may be hand or power driven, and in single or multiple parallel units.

THE PACIFIC TANK Co. will, on or about June 1, move its San Francisco office to 318 Market street. An exhibit of articles manufactured and handled will be maintained at the new location, and the management invites mining men to make its office their headquarters when in the city. A new 'Mining and Cyanide' catalogue, No. 7, issued by the company, will be ready for distribution June 1, and will be sent free of charge to anyone interested. The catalogue is an especially handsome one, embracing 128 pages, and includes, besides a description and illustration of all tanks, supplies, and accessories for sale by the company, numerous pages of tables and useful information.

BROKEN STEEL TAPES may be quickly mended by a repair kit recently put on the market by the Chicago Steel Tape Co. A thin metal sleeve, made to fit all widths and thicknesses of tapes, is coated on the inside with a composition of solder and flux which melts at so low a temperature that it makes a complete adhesion with the broken ends of the tape when heated by an ordinary match. This repair can be made in the field in a minute or two, without taking the temper out of the tape or obstructing its being coiled in the case. The splicing sleeves are put up in small round wooden boxes which hold several dozen sleeves and yet can be carried in a vest pocket.

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Editorial.

THIS ISSUE of the MINING AND SCIENTIFIC PRESS rounds up to the goodly number of 2500 since it first appeared, a little over forty-eight years ago. By virtue of superiority in age, supported further by a record of dignity, ability, and honesty throughout this long career, it may consistently claim preeminence as dean of the periodicals devoted to mining in the Western World.

IN THE TEN YEARS between 1890 and 1900, the population of the United States increased from 62,947,714 to 75,994,575, and the estimate for 1907 was 85,532,761, or a gain of 36 per cent in 17 years. During this period the circulation of currency per inhabitant increased from $22.82 to $32.22, an increase of 41 per cent. The production of pig iron, which was 9,202,703 in 1890, rose to 25,781,361 tons in 1907, this being a gain of 180 per cent. These figures are eloquent.

THERE ARE 73 tube-mills in use on the Rand, in 28 different mills, and the employment of them for re-grinding the pulp issuing from the mortars has permitted an increase in stamp-duty, so that in 10 mills it is in excess of 7 tons, the maximum being 9.2 tons per stamp per day in the Luipaard's Vlei mill. This is a violent contrast to the old mills in Gilpin county, Colorado, where a duty of less than one ton was so long the best obtainable, when crushing fine and amalgamating inside the mortar.

OUR LONDON correspondent points out that America is far behind Great Britain both in legislative and customary recognition of the liability of employers in the case of accidents to workmen and in provision for their general welfare. The plan of granting vacations under pay to men working for daily wage, inaugurated by the great firm of Brunner, Mond & Co. as a means for improving the steady attendance of laborers, is in advance of anything embodied in the Field System. The results obtained are very remarkable, and demonstrate anew how responsive is human nature to the principle of reward for the continuous performance of duty, when the object is some specific prize to be won.

A PRACTICAL concession in the way of adjustment to business requirements is the cut in the price of steel made by the United States Steel Corporation on June 9. The important changes are: billets reduced from $28 per ton to $25, Pittsburg sheet bars from $29 per ton to $27, Pittsburg plates from $1.70 per 100 pounds to $1.60, structural iron from $1.70 per 100 pounds to $1.60, merchant pipe, a reduction of two points or $4 per ton, wire nails from $2.05 per 100 pounds to $1.95. This will encour-

age industry, for although the reduction is not great, in the aggregate it looms large, and will prove a substantial aid in the recovery of normal conditions. At least such was the view of the independent steel-producers at the instance of whom the United States Steel Corporation is said to have made the concession. The detrimental influence of a great monopoly, however, immediately comes to the front. Under normal competition buyers could forecast future prices with some degree of certainty. They surely would hesitate and buy sparingly in a declining market until bottom had apparently been touched. But the law of supply and demand is disturbed in its operation when a great corporation is able to dictate. The buyer demands a guarantee of fixed prices for a reasonable period of four to six months. Failing this he is compelled to buy only for the pressing necessities of the hour. The cut in prices, accordingly, is a concession, an adjustment to the requirements of trade, and will, of course, facilitate recovery of business activity, but it misses being a stimulus, because back of it lies not the governing power of natural law, but the irresponsible whim of a few individuals.

THAT COMFORTABLE word 'metasomatic' is evidently destined to yield prominence in mining geology to 'magmatic,' for the introduction of the idea of waters of magmatic origin as a factor in forming ore deposits has led already to many careless inferences and interpretations. For this reason we give especial welcome to the article by Mr. Lewis T. Wright on 'Diffusion as a Factor in Ore Deposition,' wherein he discusses and analyzes the true meaning of the physics of magmatic differentiation. The comparison with a copper slag is most suggestive and illustrates how practical metallurgy can illuminate geo-physics. Mr. Wright's further remarks in extension of the subject of diffusion as a phase of osmotic pressure and the transfer of minerals without actual circulation of solutions, which has been discussed in our columns before, will provoke careful thought among mining geologists. We are much indebted to him for a kind of article most likely to aid the cause of scientific enquiry, in which speculation is subordinated to the probabilities following from the application of the phenomena and laws of physical chemistry.

Revision of Mexican Mining Law.

THE mining laws of Mexico have long been noteworthy for their liberality. The foreign colony has, of course, found matter in them for complaint, but that is of relatively small moment. The Anglo-Saxon rarely adopts the country of his accidental residence; he insists upon being not simply an alien, but an exile, magnifying the virtues of home and blaming his hosts for their contentment with strange ways and laws. Except for criticism of Mexico the conversation of the 'exiles' in the lobbies of the Palace and the Guardiola hotels would lack piquancy. But the foreigner knows that he has been well treated in Mexico. He can denounce mines and *baldio* lands on equal terms with native-born citizens of the country; moreover he can apply for and obtain patent to mines and lands without relinquishing his foreign allegiance. The only limitation is that acceptance of this generous privilege, of a sort which is absolutely denied to aliens in the United States, carries with it submission to the jurisdiction of the Mexican courts in all civil obligations of every nature arising in connection with such property. In other words, being admitted to the enjoyment of the full property rights of a Mexican citizen without having to become naturalized, he may not, when in difficulties, play the baby and appeal to the diplomatic representatives of his country for special privileges and claim exemption from the law of the land. A foreign corporation may enter Mexico, after having obtained a certificate of incorporation from the State of registry, and having the certificate acknowledged in due form before the nearest Mexican consul; this certificate, naming the officers and directors, and the accredited agent or attorney of the company for Mexico, being required to be officially translated and protocolized. The stamp-tax having been paid on the authorized capital stock, the company can then transact business, acquire property, and obtain patent to mines and lands through its proper agent, the same as a Mexican corporation. Here again the Mexican law out-does that of the United States in liberality. Our Federal statutes permit aliens, either individuals or corporations, to locate mining claims, but not to acquire patent, except such alien be a *bona fide* resident of the United States, and upon ceasing to be a resident, the property must be conveyed within ten years to those competent to hold it under our laws. The State laws incline to greater liberality in according privileges to aliens than do the Federal statutes. This is a product of the spirit of rivalry, of competition, and of growth, the same spirit that prompted the enactment of liberal alien laws in Mexico and in nearly all Latin-American countries, which are richer in natural resources than in capital for exploiting them. The tightening of the lines in Mexico is a symptom of maturity and strength, not of antagonism and racial prejudice. It is unjust to a sister nation that has freely shared with us her birthright, to ascribe mean and petty motives when she feels strong enough to claim her prerogatives. Whether indeed she be fully able to stand upon her dignity in this matter is a query open to the challenge of opposite opinions, both in and out of Mexico. The remarks of Señor José L. Requeña, President of the Mexican Chamber of Mines, indicate that strong men think the time is not yet ripe for the Republic to limit the privileges of the alien. These are questions of policy which are more likely to be adjusted to the advantage of the beneficiary through generous discussion than by condemnation and abuse. We believe that the spirit of the proposed revision of law could not be better shown than by the fact that among the reforms is that of excluding alien attorneys from practice before the Mexican bar. No alien is admitted to the bar in the United States, nor in the British Empire, nor for that matter, in any first-class nation in the world. Let us be just.

The Amalgamated Report and Copper Costs.

THE great copper mining companies operating at Butte, Montana, persist in withholding information from the public concerning the details of their management. This means two things: that the details would not justify the management in the financial results obtained, and that the public is willing to bet on a copper faro game even when it has good reason to believe that the cards are dealt out of a 'brace-box.' Nevertheless, there is a growing tendency toward speculation rather than toward gambling in those mining stocks which may rightly be classed along with industrials, due regard being had for the necessity of amortization of capital. The Amalgamated and the Anaconda are essentially public corporations, unlike the Calumet & Hecla, which, though listed on the Boston Stock Exchange, is controlled as a close-corporation by four or five men. The Amalgamated and Anaconda reports just issued are superior examples of what mining reports should not be. No data are given by which an outsider may check the conclusions of the apologists in whose behoof these annual addresses to stockholders are made. In the report of the Amalgamated Copper Co. the falling off in earnings from $15,154,400 to $6,680,-557, or 56 per cent, from one year to the next, is explained by the misleading affirmation that in May, 1907, there was an unlimited demand for copper, the selling price at that time being about 25 cents per pound, and that this demand was "seriously affected by the severe financial depression throughout the country." Anyone closely in touch with the copper market knows that precisely in May, 1907, there was a conspicuous absence of buyers, and that the stocks of copper were piling up at such an alarming rate as to make a sharp recession of prices inevitable. Moreover, this condition of the market was a precursor of the financial crisis which followed as a storm five months later. Declining copper prices meanwhile indicated the approaching industrial depression with the fidelity of a falling barometer. The highest price touched by the metal was 26¼ cents, in March, 1907. This was purely artificial. There was no legitimate demand to warrant it. In May the quotations stood at 25¼ cents; in June a weakening to 24⅞ cents took place. In July Mr. Rogers returned from Europe, full of assurance to the public, but in practice revealing that he was not as wanting in wisdom as he seemed. The arrangement with Phelps, Dodge & Co. occurred almost immediately after, by which the great Arizona copper people undertook, in combination with the Butte producers, to fix a price of 22½ cents. This agreement in itself was sufficient to have precipitated a panic. The weakness of two of the greatest factors in the world's copper market, in the face of persistently high quotations for many months, and in the midst of boom times, was thereby revealed. It gave the lie to all announcements from Amalgamated headquarters of an active demand for copper, and it demonstrated moreover that these concerns could not in reality fix prices, as they presumed to do. The reduction naturally weakened the demand still further, and shortly afterward there was someone selling largely under the market, which immensely accelerated the downward movement. The price dropped to 18¼ cents in August, to 14⅞ in September, and to 12⅛ in October, by which time the signs of impending general financial disaster were conspicuous to the world. It must be noted that selling fell off in April, and that practically no sales were made during the period of shrinking prices. The European demand was enormously exaggerated, and the heavy exports of copper chronicled at the time were to a large extent taken by speculators, and remained threatening the market. It is evident that the Amalgamated officials count on ignorance, or lack of inquisitiveness, on the part of the stockholders when they dare to issue statements so directly in contravention of facts easily accessible to anyone.

prices realized by the great copper producers were by the Amalgamated Copper Company's fiscal year, ending April 30, 1908, was 20 cents. Actually the prices realized by the great copper producers was nearer 17 cents. The Calumet & Hecla averaged a better figure, due to its policy of avoiding accumulation of stocks, showing that it is more profitable to follow a market that is subject to normal economic laws of competition than to try to restrict it where absolute control cannot be obtained. The causes of failure on the part of the selling companies to realize the benefits which high prices presumably should give, were shortage and inefficiency of labor; high prices of material; treatment of lower-grade ores, running up the cost per pound of copper produced; extravagant enlargements of plant and great increases in mine-exploratory work; and the necessity imposed by over-production for carrying large stocks of metal far beyond the period of high prices.

Finally, a large factor in the increase of costs, not only of producing copper, but of all industrial operation, was the disorganization of the railroad transportation service throughout the country. The delay in forwarding cars was so extreme that consignments from the Middle States to Colorado common-points, which include Salt Lake and Butte, were generally about four months in transit. Not only did this add to the cost of conducting any enterprise, through the consequent delays and embarrassment of management, but it added directly to the outlay for freight through the graft which flush-times and traffic-demoralization fostered. The practice of tipping yard-masters and other railroad employees to forward cars became a wide-spread scandal. A company was incorporated in San Francisco for the purpose of tracing lost carload shipments and insuring prompt deliveries for a fixed fee per car, which depended, of course, upon collusion with those who had the power to facilitate or impede the movement of freight. This is perhaps a solitary example of incorporating and financing graft as a recognized industry—a fit offspring of protected bribery in this unfortunate city. So far as conditions in the United States are concerned, the railroad situation had much to do both with checking the development of industry, on which copper consumption depends, and with increasing the cost of the metal to the producers.

Personal.

ALBERT BURCH has gone to Arizona.

ROBERT T. HILL is at Goldfield, Nevada.

JOHN A. REID is at Stockton, California.

CARL HOFFMAN has returned to Mexico City.

CLIFFORD G. DENNIS was in San Francisco last week.

ALFRED J. G. SWINNEY has returned to London from India.

F. PERCY ROLFE is on his way from London to Colombia.

T. A. RICKARD sailed on June 19 from Seattle for Alaska.

P. G. HOLMS has removed from Mexico City to Guadalajara, Jalisco.

W. D. PIERCE, of Chihuahua, Mexico, was at Goldfield this week.

DONALD B. GILLIES was recently at Rhyolite and Tonopah, Nevada.

CHARLES W. GOODALE is in San Francisco in the course of a holiday trip.

JUAN FELIX BRANDES is at Parral, Mexico, and will soon visit San Francisco.

A. H. DOUGLAS, of Rawhide, Nevada, is spending a few days in San Francisco.

GEORGE MAINHART has resigned as manager of the Champion and Delhi mines, at Grass Valley.

H. G. MORRIS, formerly of Colorado, is now superintendent of the Florence mill, Goldfield, Nevada.

VICTOR C. HEIKES, of the U. S. Geological Survey, is visiting various mining districts of Nevada.

HOWARD D. SMITH, after spending a week at Rawhide, Nevada, has returned to San Francisco.

F. L. RANSOME is at Goldfield for the purpose of completing his survey of the Goldfield district.

F. LYNWOOD GARRISON, of Philadelphia, sailed from New York on the 17th for Colombia, South America.

FRANK J. BOOTH is here from western Chihuahua, Mexico, in search of information concerning gold dredging.

JOHN B. KIRCHEN has been appointed general manager of the Montgomery-Shoshone property at Rhyolite, Nevada.

WALTER NEAL, superintendent of the cyanide department of the Dos Estrellas mill, El Oro, Mexico, is in San Francisco.

E. N. ATKINS, of the firm of DEGOLIA & ATKINS, San Francisco, is examining mining property in Trinity county, California.

A. A. TALMAGE, for some years manager for the Bialsdell Co., is now Pacific Coast manager for the Pittsburgh-Salt Lake Oil Co., with offices at Los Angeles.

ALEXANDER LEGGAT has resumed practice as mining engineer, having resigned from the position of City Engineer of Butte, Montana. His offices will be at Butte.

ROBERT H. RICHARDS has returned to Boston from Missouri, where he has been engaged professionally. While there the University of Missouri conferred upon him the degree of Doctor of Laws. He was the guest of honor at a dinner given on June 6 at the University Club, Boston, in recognition of his forty years of teaching at the Massachusetts Institute of Technology.

L. VOGELSTEIN & CO., of New York, give the following figures of German consumption of foreign copper for the period January to April, 1908:

	Tons.
Imports of copper	56,533
Exports of copper	2,723
Consumption copper	53,810

as compared with consumption during the same period in 1907, of 36,255 tons. Of the above quantity 52,259 tons were imported from the United States.

Latest Market Reports.

LOCAL METAL PRICES—June 18.

Antimony	12@16c	Quicksilver (flask)	$45@45.50
Casting Copper	14¼@15¼c	Spelter	6½@ 7¼c
Pig Lead	4.85@ 5.80c	Tin	31¾@33¼c

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date	Electrolytic Copper	Lead	Spelter	Silver
June 12	12.69	4.50	4.56	53⅜
" 13	12.75	4.50	4.54	53⅜
" 14	Sunday.	No market.		
" 15	12.75	4.50	4.54	54
" 16	12.75	4.50	4.54	53⅞
" 17	12.75	4.50	4.54	53⅞
" 18	12.75	4.50	4.54	54⅛

ANGLO-AMERICAN SHARES.

Cabled from London.

	June 11. £. s. d.	June 18. £. s. d.
Camp Bird	0 13 0	0 13 0
El Oro	1 5 0	1 5 0
Esperanza	1 10 6	1 10 0
Dolores	1 5 0	1 5 0
Oroville Dredging	0 11 0	0 10 9
Stratton's Independence	0 1 9	0 1 3
Tomboy	1 13 9	1 13 9

(By courtesy of W. P. Bonbright & Co., 24 Broad St., New York.)

MINING STOCK QUOTATIONS—NEW YORK.

	Closing prices. June 11.	June 18.
Amalgamated Copper	68	68¼
American Smelting & Refining Co	75⅞	77
Boston Copper	11⅝	11½
Butte Coalition	23	22⅞
Cumberland Ely	7¾	7⅛
Dolores	7	7⅛
El Rayo	2	2⅜
Giroux	3⅜	3¼
Greene-Cananea	10	11
Indiana Sonora	4¼	4½
La Rose		7¼
Miami Copper	5¾	5⅝
Nevada Consolidated	11⅞	11⅝
Newhouse	6⅞	6⅛
Nipissing	7¼	7⅜
Ohio Copper	2½	2¼
Tennessee Copper	37	36
Utah Copper	31½	31½
Yukon	3⅞	3¾

(By courtesy of Trippe & Co., 25 Broad St., New York.)

SOUTHERN NEVADA STOCKS.

San Francisco, June 18.

Atlanta	$ 18	Laguna	1.00
Belmont	82	Manhattan Con	10
Columbia Mtn	15	Midway	36
Combination Fraction	48	Montana Tonopah	1.45
Daisy	75	Nevada Hills	1.85
Fairview Eagle	55	Rawhide Queen	1.65
Florence	3.12½	Sandstorm	23
Gold Bar (Bullfrog)	5	Silver Pick	15
Goldfield Con	5.47½	St. Ives	26
Gold Kewanas	26	Tonopah Extension	80
Great Bend	26	Tonopah of Nevada	8.00
Jim Butler	23	Tramp Con	13
Jumbo Extension	26	West End	46

(By courtesy of W. C. Ralston, 353 Bush St.)

COPPER SHARES—BOSTON.

	Closing prices. June 18.		Closing prices. June 18.
Adventure	2	Michigan	9¾
Ahmeek	70	Mohawk	62½
Allouez	28	Nevada Con	11⅝
Amalgamated	68⅜	North Butte	68
Arcadian	3¼	Old Dominion	36¼
Atlantic	16	Osceola	92
Bingham Con	65	Parrot	23¼
Boston Con	11¾	Phœnix	
Butte Coalition	23	Quincy	84
Calumet & Arizona	108	Rhode Island	3⅜
Calumet & Hecla	670	Santa Fe	1⅞
Centennial	24¼	Shannon	13¼
Con. Mercur	42	Superior & Pittsburg	12⅜
Copper Range	73	Tamarack	58
Daly-West	10⅝	Trinity	13⅛
Franklin		United Copper com	7
Granby		Utah Copper	31¼
Greene-Cananea, etf	11	Victoria	4¼
Isle Royale	18¾	Winona	5⅞
Mass	4¾	Wolverine	103

General Mining News.

ALASKA.

The region around the Innoko river, a lower tributary of the Yukon, is the scene of a stampede, according to Associated Press dispatches. It is said 800 men from Fairbanks alone have gone to the scene of the strike, which was made last spring, and that freight and passenger accommodations on three steamers leaving there recently, were completely sold out.——The *City of Seattle* landed a large shipment of gold from southwestern Alaska, at Seattle, the first of the week. She is the first treasure ship of the season to reach port from Fairbanks by way of the Skagway route.——The first boat of the season has reached Nome, after a delay of nearly ten days spent in fighting ice and fogs in Bering Sea.

ARIZONA.

COCHISE COUNTY.

Louis W. Hill, president of the Great Northern railway, who is heavily interested in the Shattuck Mining Co., was in Douglas last week, and is authority for the statement that the smelter would be built and that actual construction would be started within three months.

GILA COUNTY.

The prospects in the Globe district continue to be quite satisfactory. Since the first of the month the Warrior Copper and the Superior & Boston have increased their ore shipments considerably, while the Gibson, United Globe, and Arizona Commercial are maintaining their tonnages. The Old Dominion has four furnaces in blast, and the production of copper for the current month promises to be in the neighborhood of 3,000,000 lb. The Old Dominion Co. will at an early date commence shipping sulphide ore from Dalton, Cal., to its smelter, the product being desirable on account of the high percentage of sulphur and iron it contains.——The Gardner shaft, which will develop the Iron King and Black Oxide claims, has reached a depth of 90 ft. and is going down at the rate of two feet per day. It has three compartments—two each 4 ft. 6 in. by 5 ft., and one 4 ft. 6 in. by 5 ft. 7 in.—and is one of the best constructed shafts in the Globe district.——A steel tank with a capacity of 20,000 gal., for the storage of oil, is being erected at the Great Eastern shaft.——The Gibson Copper Co. has abandoned work temporarily on the new vertical shaft and is developing on the fifth and sixth levels of the old shaft and making stations in the new. The new vertical shaft is between the third and fourth levels and is 250 ft. west of the old shaft.

MOHAVE COUNTY.

S. C. Bagg, of Gold Basin, has taken a lease and bond on the Golden Rule mine and the Cyclopic mill, and is to operate both.——G. B. Ayers has recently shipped an $8000 bar of bullion, being the clean-up of a two weeks' run on the mill-dumps at Goldroad. This gold is recovered by a method of spraying the dumps with cyanide solution and pumping back to the mill the percolations from the mass. There is practically no expense connected with the recovery, the process being entirely automatic.——The McCracken Mining Co. is building a telephone line from Yucca to the mines, a distance of 36 miles.

PINAL COUNTY.

The Lake Superior & Arizona Mining Co. has resumed operations at its plant at Superior and expects to use 100 miners at once.——The Eagle Mountain copper mine, on the south bank of the Gila, opposite the Ray mills, has been sold to a company of Wisconsin capitalists represented by T. H. McGrath. The same company has also purchased the south half of the Sultana National. Both of these properties are near the new station of Erman, which is on the Phoenix & Eastern railroad, one mile east of Kelvin.

YAVAPAI COUNTY.

The Monica will have 10 additional stamps dropping in its mill within the next 20 days, and the slime plant is nearly completed.——It is reported that the Mount Elliott Con. Mines Co., which owns a group of claims in the Bigbug district, one of them being the well known Dividend mine, will double the capacity of its existing 10-stamp mill, and put in a new air-compressor.

YUMA COUNTY.

A company has been organized to work the Cobrallo group of nine claims, in the Harcuvar mountains, nine miles northwest of Salome.

CALIFORNIA.

CALAVERAS COUNTY.

The Boston mine, two miles northeast of Mokelumne Hill, is lengthening its adit and expects to build a stamp-mill. Thos. McSorley is superintendent.——The Reiner gravel mine, at Altaville, is working three shifts in sinking, and a depth of 85 ft. has already been reached. A steam hoist has been installed.——The Flour Sack mine, at the head of Fishers gulch, has been taken over under lease by Joseph Hamby of Mokelumne Hill. This property is noted for arsenical sulphides and flakes of gold, and is an extension of the celebrated Mammoth mine, just across the river in Amador county.

Map of California.

NEVADA COUNTY.

(Special Correspondence).—An 18-in. vein of ore milling $27.50 per ton is exposed at the bottom of the shaft in the Midas. It is said the ore can be mined and milled at $7.50 per ton. Work will start immediately to sink the shaft and push developments.——The American M. & M. Co. is preparing to start work on an adit on the Watts gravel mine, at Snowden Hill. It will cut the bedrock at considerable depth below the old workings and is expected to develop a large body of gravel. The necessary buildings at the mine are practically completed.——Henry Goering and L. M. Clark, of Nevada City, have acquired a large area of placer ground at Round Mtn. The property has been developed by an 800 ft. adit, which will be extended 300 ft. farther. A company will be organized and stock sold to raise funds for extensive development. The property is located in the Washington district.——The Sierra Queen mine has been bonded to a company known as the Sierra Queen Con. G. M. Co. and will be extensively operated according to the present plans of the management. A 400-ft. shaft has been sunk on the property and considerable driving done. The

new company is an Arizona corporation, capitalized at $1,000,000. Clifford J. Graham is consulting engineer.——John McM. Ross and John Hall have completed their examination of the Champion and Delhi mines for an English syndicate. They have been engaged in the work six weeks.——A new underground hoist is being installed at the Delhi mine. The 20-stamp mill is running steadily on good ore.——The adit at the Native Son mine, near Blue Tenet, has been cleaned out and cross-cutting will be immediately started.——Active developments will be soon resumed at the old Richmond mine. The mine is situated near the Jenny Lind.

Grass Valley, June 15.

SAN BERNARDINO COUNTY.

The Fremont M., M. & D. Co., at Barstow, has recently installed a new engine and hoist and is now hoisting ore. The management proposes to erect a 10-stamp mill in the near future.——The new custom mill, at Daggett, is running at its full capacity.——A quantity of placer mining machinery is being shipped to the Coolgardie mining district, 20 miles north of Barstow.

SHASTA COUNTY.

The office and store-room of the Backbone mines, eight miles west of Kennett, burned last week, but will be rebuilt at once.——The Bracket mine, in the Lower Springs district, has been re-bonded to the same Eastern company which has heretofore held it.——The Balakiava mine, at Coram, which has recently resumed, is working 10 or 12 miners. One furnace of the new smelter will probably be blown in during the latter part of July, although the complete plant will not be running full blast until fall. The power plant is nearly completed.

SIERRA COUNTY.

The flume of the Last Resort mine, east of Downieville, is being repaired, preparatory to starting the assessment work.——Morrel & Rae have taken an option on the Tom Boy claim, two miles from Forrest. They have made a cash payment of $500 and let a contract to extend the adit to intersect the vein.——Fleming & Smith have taken an option on the Good Faith mine, at Downieville, and have started work on it.

TEHAMA COUNTY.

It is probable that the California & Massachusetts Copper Mining Co. will resume work at its property on Tom Head mountain.

TUOLUMNE COUNTY.

The Harvard mill, at Jamestown, will start 10 additional stamps dropping this week, making a total of 50.——The Big Four mine, one-half mile east of Tuolumne, reports the finding of a 15-in. vein bearing free gold.——Operations were resumed last week at the Sierra Lime & Cement factory, south of Sonoma.——The Riverside mine, above Soulsbyville, is to re-open.——The Omega mill is nearly completed and the tramway between it and the main shaft is ready for service.——The shafts of the Wild Cat, above Soulsbyville, are being cleaned out and hoisting machinery installed, preparatory to starting development.——The bond on the Ida Klein mine, in Yorktown gulch, has been extended for 30 days, and underground work is to be started.——J. L. Tonkin has bonded his Wet Gulch property, three miles northeast of Columbia, to Remington & Ivy, of Seattle. The shaft is 135 ft. deep, the orebody at that depth is 3 ft. wide and assays $20 per ton in gold.

COLORADO.

CHAFFEE COUNTY.

Work has been started on a new smelter at Buena Vista. The project is being financed by capital of that city, Salida, and Denver, and ground for the plant was broken last week. It is expected that the buildings will be completed and the machinery in operation about the first of the year. The smelter will handle lead ores.

CLEAR CREEK COUNTY.

(Special Correspondence).—Carlson & Co., leasing through the Sidney adit, have sold their privileges to the East Argentine M. Co. A big force of men is to be worked in extending the drift and stoping. The orebody measures from 18 in. to 3 ft. wide, and assays $70 per ton in silver and lead.——J. J. White has taken a bond and lease on the Princess of India adit and group of claims, on Columbia Mtn., the bond calling for $30,000, with a payment of $10,000 being due one year from date. Mr. White will transfer his privileges to Jas. A. Mears, who recently purchased the American Sisters mine. The Princess of India adit, now in 800 ft., is to be advanced 1000 ft. to intersect the American Sisters vein at an increased depth of 600 ft. under the present deepest workings of that property. A compressor plant is to be installed at once, and the machinery will be on the ground within 30 days. It is understood that the American Sisters holdings are to be consolidated with those of the Accord M. & M. Co., operating a large group of claims on Saxon Mtn. S. Peacock has been appointed general manager.——More ore is being delivered at the local sampler at present than at any time since the panic of 1893. During the last week the average returns received from the product milled was 1.23 oz. gold, 22½ oz. silver, and 36.39% lead.——An enormous body of ore has just been uncovered on the Independence vein, intersected through the Tobin adit workings. The smelting streak is from 3 to 4 ft. wide, and 6 to 7 ft. of mill dirt alongside shows assays of 1.14 oz. gold, 35 oz. silver, and 11% copper. It will be necessary to mill the entire product as a smelting ore, for the reason that the mill located near the Wilcox adit is equipped only for the handling of lead-silver-zinc ores.——A body of $75 smelting ore 3 ft. wide has been struck on the Paymaster vein, cut 3600 ft. from the Wilcox adit entrance. The ore is a heavy lead, and driving is now in progress for the opening of the ground to permit of stoping.——Ericson & Anderson, leasing in the upper workings of the Seven-Thirty mine, have encountered a streak of high-grade ore in the extension of the drift westerly. The initial shipment gave returns of 340 oz. silver per ton. By continuing the drift for 100 ft. the heading will cut directly above the ground being operated by Luizetti & Co., who have been maintaining shipments of high-grade ore for over a year past.——An electric trolley system is to be installed at once at the Capital mines, near Georgetown.——The aerial tramway constructed from the Seven-Thirty dumps, the terminus of which is at the Pelican mill, was put into commission last week. The ore is being delivered at the bins and there is ample material now available for the running of the concentrator, which will be started next week.——Raising has been started from the Joplin adit to connect with the Gambetta shaft workings, a distance of 380 ft. After going up 20 ft. the shoot is still in evidence, the ore assaying 2 oz. gold, 50 oz. silver, and 62% lead.——George S. Wilkie, of Idaho Springs, has been engaged to make a number of tests at the Stanley mill upon ore from that property. The mill is to be enlarged and constructed along lines calculated to produce the greatest efficiency.

Georgetown, June 15.

EL PASO COUNTY.

The Cottonwood Coal & Power Co. has been incorporated at Colorado Springs to do a general coal business. The company owns 320 acres of coal land adjoining that of the Pikes Peak Fuel Company.

LAKE COUNTY.

(Special Correspondence).—The total production of the Leadville district for the month of May amounted to approximately 70,000 tons, or an increase of 5000 tons over the preceding month. Although many small properties have resumed since the financial flurry last fall, several large mines are still idle.——The shaft on the Forepaugh mine has been re-timbered and a new shaft-house will be built before operations are resumed. The old shaft-house was destroyed last fall by fire.——A number of old properties on Fryer hill are resuming, owing to the demand of the smelters for iron ores for fluxing.——The newly discovered orebodies in the Across the Ocean property, on Breece hill, will be developed through a new shaft which the company is now sinking. An entirely new equipment will be installed

by T. J. Gilroy.——After a protracted period of development, involving the sinking of the shaft and driving a drift to the old ore-shoot, the Silent Friend has opened what is probably the largest body of ore it has ever shown. Shipments at the rate of 1000 tons per month are in progress. Apparently the ore is of the same high character as that mined in the past.——Arrangements are being made for extensive placer operations on the old Derry ranch, between Leadville and Twin Lakes.——The recent strike on the Clipper property, south of the city in Hayden gulch, has created considerable interest. The Clipper is an extension of the Mayflower, which was an important producer for more than twenty years.

Leadville, June 15.

The Ballard, on Breece hill, at Leadville, is to open soon. This property has been the subject of much litigation in the past, and has been a large producer of bismuth.——There has recently been a revival of the discussion of the proposed tunnel that is to cut Mosquito range, connecting the Park county side with Lake county, at a point not far from Leadville.——Arrangements are being made to build a dredge on the Mekka placer, near Breckenridge.——The Hellena, in Iowa gulch, is being put in shape to begin operations on an extensive scale. The shaft is 600 ft. deep and it is necessary to pump 200 gal. per minute in order to keep it dry.

SAN JUAN COUNTY.

Shipments of concentrates from the Silverton district for the month of May were as follows: Silver Lake, 2100 tons; Gold King, 2000; Hercules, 575; Sunnyside, 250; Old Hundred, 50; Hamlet, 50. The following are the shipments of ore: Shenandoah-Dives, 250 tons; Highland Mary, 50; Detroit-Colorado, 25 tons.——The Domingo adit, near Eureka, is being put in shape for operation.

TELLER COUNTY.

The Gold Coin and the Granite properties shipped a total of approximately 100 cars during the month of May.——The Northwestern Iowa M. & M. Co., operating several claims on the south slope of Trail Mtn., 5 miles south of Victor, will resume at once. There is a 75-ton cyanide mill on the property.——A leasing company has been formed to work the Prinsett properties, which include a large number of claims in the Cripple Creek district. The life of the lease is three years. Operations will be started soon, and will be carried on through the Moffat tunnel under Gold hill.——May & Jenkins, lessees on block four of the Ajax Gold Mining Co.'s property on Battle Mtn., are installing an electric hoist and will soon commence to hoist ore.

IDAHO.

BOISE COUNTY.

The Boulder mill has been started, running on ore from the Mollie McCarty mine, one of the Boulder group. The ore is being transported by the new tramway, recently completed.—Suydam & Balbach have thrown up their lease on the Washington mine, on account of lack of capital.——Peter Reichert is to work a small vein of free-gold ore which he has recently discovered on Lost creek, 28 miles northeast of Idaho City. The vein is from 1½ to 3 in. wide, but assays $1100 per ton.

IDAHO COUNTY.

(Special Correspondence).—A rich strike on the Snow Storm mine, in the Elk City district, has caused some excitement there. The ore was taken from the bottom of the lower adit, about 110 ft. from the portal, and contains free gold.——The Hush placer mine has made its first clean-up, representing 20 days mining, the amount of which is not made public. This is one of the newer mines now under active development, and it has been improved recently with flumes and ditches.——The shaft being sunk in the Buster mine from the 300-ft. level is down 50 ft., and is reported to have struck the contact with the vein. The Buster is making regular clean-ups, and is so far the largest and most steadily worked property in the district.——Material, supplies, and new equipment are being sent to the Blue Jacket mine, on Salmon river, where the driving of a new adit will be started soon. There is already a 1000-ft. adit connected with a 500-ft. shaft. The new adit will start 250 ft. below the other, to test the depth of the orebody.

Elk City, June 13.

SHOSHONE COUNTY.

(Special Correspondence).—The Snowstorm mine, at Mullan, has stopped breaking ore because of a shortage of cars. The floods have shut off the supply and it is doubtful when more can be supplied. The Hunter mine is also curtailing its force.——A report from Wardner states that the Stewart, Mr. Heinze's mine, is to be re-opened, and that supplies are being laid in.——The management of the Star mine states that development will be continued during the summer, with as large a crew as can be advantageously worked, on the 800-ft. level, and that the company will erect a mill of its own next year if sufficient ore reserves are opened up. A crew of 18 men is now at work.——The Hercules mine now employs about 250 men, breaking ore on the second, third, and fourth levels. During the month of May 23,000

The Coeur d'Alene, Idaho.

tons of ore were shipped, most of which went to the East Helena smelter.——The Tamarack & Chesapeake has again put three machines in operation and will also use a crew of hand-drillers in developing.

Wardner, June 16.

WASHINGTON COUNTY.

The Wilson-Pack Co. report a strike of rich free-gold ore, at its claims on Hornet creek, 15 miles from Council. The owners claim to have a large vein at a depth of 30 ft. which assays $20 per ton.——The Pueblo & Columbia mines, in the Big Creek district, has increased the force of men by 10, making a total of 30 now employed.

KANSAS.

CHEROKEE COUNTY.

(Special Correspondence).—A rich lead strike was made in the shaft being sunk by the Luther Mining Co. at Baxter Springs, south of the Omaha mill. The ore was struck at 50 ft. and the drifts show a 12-ft. face. This is the same run as that found in the Lancaster, south of the Luther. This makes four adjoining properties showing a rich run of ore, proving that this part of the camp is underlaid with a fine orebody.——The Hawkeye mine is producing six to eight tons of concentrates per shift, nearly half of which is

lead ore.——The Heap-O'Brien mine shows a 30-ft. face of zinc-blende and galena. A new mill is to be installed at once.——Ore has been struck on the Catholic 'forty' by Robert McKay. He is at present pumping the property and pushing development work. Ore was struck at 118 ft. and continued to 152 ft. This is one of the deepest ore-beds encountered in the Baxter Springs camp.——The Eastman Investment Co. has been doing extensive development work. Twenty-elght drill-holes have been put down, and two shafts are now down to the orebody, furnishing about 150 tons per day to the White Eagle mill. The machinery of the plant has recently been overhauled and additional jigs and tables installed, which will increase the tonnage of the mill. A third shaft will be sunk in the near future.—— Work on the Big Chief mill is being pushed and it is hoped that it will be completed by July 1. Development work has advanced to such a point that the mill can be kept in steady operation as soon as completed. The orebody struck here is the same as that found on the Mission lease, and shows a 30-ft. face.——Preparations are under way for the re-opening of the Cave Springs camp, which has been idle for some time and was at one time the leading producer of the Joplin district. The Murdock-McCullagh Mining Co., of Galena, has taken over the lease upon the tract and will drain the main part of the camp.——The Victoria mill, on the New Century lease, is being torn down for removal to the Delta lease, in the same locality. About five weeks will be required for the removal and re-construction of the plant.

Galena, June 15.

NEVADA.

CHURCHILL COUNTY.

A movement is on foot to establish a power station at Chalk Mtn., half way between Wonder and Fairview. It is planned to transmit the power from the headwaters of the Carson river in Alpine county, California, 140 miles distant. P. H. McLaughlin, of Fairview, and H. J. Darling, of Reno, are interested.——Development on the IXL mine, about twenty miles from Wonder, is to be resumed.——The Gibraltar Investment Co., of Denver, has secured control of the Queen group of claims, in the Wonder district.

ESMERALDA COUNTY.

(Special Correspondence).—The new mill of the Homestake Mining Co., near Rhyolite, is ready to start. The plant has 25 stamps of 1050 lb. each, 3 tube-mills, with amalgamating plates following both stamps and tube-mills. The mill will have a capacity of 125 tons per day and will be operated by electric power. At the mine, a new Ingersoll-Rand air-compressor, driven by a 60-hp. Western gasoline engine, supplies power for three Ingersoll and three Waugh drills.——The Montgomery-Shoshone, at Rhyolite, is mining and milling 150 tons of ore per day, the extraction in the mill being about 87%. This recovery is divided about equally between concentration and cyanide treatment. The mill is operated by electric motors and the hoisting engines and compressor by steam. The main shaft has reached a depth of 700 ft. The water being pumped from it amounts to 75,000 gallons per day.——Rich ore has recently been struck on the 400-ft. level of the Tramp Consolidated at Rhyolite.

Goldfield, June 16.

The Rogers-Syndicate lease will probably exceed the wonderful production of the Little Florence, its neighbor to the north. There has already been distributed as dividends $185,000, and it is expected that before the lease expires, on June 11, at least one-third of a million dollars will be divided among the shareholders.——A company of New York men, headed by E. W. Gillette of the L. V. & T. railway, has secured a lease on a block of ground 600 ft. square, belonging to the Goldfield Rochester Mining Co. The lessees will begin work soon.——The Albemarle has started crosscutting at a depth of 310 ft.——The Goldfield Red King Claim Leasing Co. has cut two veins in the drift at the 450-ft. level of the Red King claim on the Florence ground. A 50-hp. hoist has been installed and power-drills will be used.——F. H. Vahrenkamp has taken a lease on the Conqueror ground.——Fifty-five lessees are at work in the new camp of Granite, 8 miles west of Schurz. The town boasts a population of 250 people, and prospects for a producing camp are bright.——The Little Florence this week won its point against the Goldfield Florence in the action growing out of the charge against the former of unworkmanlike development of the mine under the Little Florence lease. The Goldfield Florence is ordered by Judge Langan to impound the money, some $170,000, involved in the litigation, sustaining the Little Florence motion, which was made on the ground that the property in dispute was being shipped to Denver.——The Goldfield mines produced, during the week ending June 12, a total of 2673 tons, valued at $195,360. The Tonopah mines, for the same period, produced 5758 tons, of an estimated value of $118,680.

HUMBOLDT COUNTY.

A two-compartment shaft will be sunk on the Therein property, in Seven Troughs canyon.——Gilliam & Scott, Minneapolis capitalists, have secured control of the Prior & Chadbourne lease on the Mazuma Hills estate.——The hoisting equipment of the Seven Troughs Florence Mining & Leasing Co., operating the Harris lease on the property of the Seven Troughs Mining Co., near Vernon, arrived in Lovelock, the nearest railroad point, last week, and is now being hauled to the lease. The equipment includes a 15-hp. Foos-Fulton gasoline hoist, head-frame, buckets, cars, and the like.

NYE COUNTY.

The Tramp Con. has made a strike of rich ore on the 350-ft. level of the Denver claim.——The Greenwater & Death Valley, the property of Charles M. Schwab, has struck copper ore assaying as high as 20%, at the 1000-ft. level of the shaft.——Parker & Keller have taken a lease on the Base Mtn. property of the Skookum Bullfrog Mining Co. and have already started work. The adit, now in 350 ft., will be extended to cut the vein at a vertical depth of 350 ft. The Skookum is two miles east of the Diamond Queen.—— The Round Mountain Mining Co. has uncovered an orebody which, it is claimed, is 160 ft. wide, and 20 ft. of that width will assay $100 per ton in gold.——The new hoisting plant at the Buckeye, east of Tonopah, is completed and sinking will be resumed. The shaft is now 300 ft. deep.

LINCOLN COUNTY.

H. A. de Rudio has taken a bond on the Ivanpah property, in the Ivanpah district, 50 miles west of Searchlight. The property consists of three groups of claims, on all of which are tungsten ore. Work has been started preparing a trial shipment, which will be sent out by way of Calavada, a station on the Salt Lake railway, 10 miles distant.

WHITE PINE COUNTY.

The 300-hp. electric hoist of the Veteran mine was tested last week and was found to work satisfactorily. The power comes from the smelter at McGill, a distance of 20 miles. ——It is expected that work will be started in a short time on the Hidden Treasure group, lying west from Lane City, and joining the Nevada Con.——D. C. McDonald, manager of the Success mine, of the Duck Creek district, has eight men employed completing the work necessary to be done before patents can be obtained.——A whim has been erected on the Sunlight claim, at the main shaft, which was 60 ft. deep, and it will be sunk deeper.

MICHIGAN.

The Keweenaw will start a second shaft near Medora this week. The equipment is on the ground. The rock-house has been completed at the Medora shaft. Sinking has been discontinued temporarily and drills used in driving.——The Mohawk mineral output for May, 607 tons, was the largest, with one exception, for any like period in the history of the company.——Grading for the railroad to the No. 5 Isle Royale shaft is practically completed, but the shaft is not ready to produce because of having 'lost' the lode. The shaft is down about 350 ft., and in the course of sinking it is expected that the lode will heave back to the shaft before the fourth level is reached. Four drills are ruuning.

MISSOURI.

JASPER COUNTY.

(Special Correspondence).—The output of the Missouri-Kansas district is still somewhat curtailed on account of the rains and flooded streams. Many of the mines, along the water courses, have installed extra pumping plants and are overcoming the water, and the output will soon be normal. The price of lead ore is still on the increase, while zinc remains stationary.——A company of Joplin men have organized the Hanover Mining Co., capitalized at $100,000, to develope a 36-acre lease on the Connor land, south of Carterville. The new lease has been carefully tested, 14 drill-holes having been sunk, all of them striking the same run of ore. One shaft has been completed to the orebody, a distance of 217 ft. While sinking the shaft a number of cross-drifts were run. Plans have been made for the erection of a 200-ton mill in the near future.——The Hennessey Mining Co. has been re-organized and has taken over the old Anderson mine and mill, at Chitwood. New machinery will be installed and the property put on a producing basis at once.——The Lizzie D. Mining Co. has been organized at Joplin, with a capital stock of $48,000. The company has a lease of 17 acres on the Malang-Matthews land, at Peacock. Six drill-holes have been sunk, all striking ore. A shaft has been sunk and ore found at 173 ft. The shaft is still in ore at 188 ft. A new boiler and pump have been installed.——The McMillan Mining Co. is making preparations to operate extensively at Four Corners, northwest of Joplin. This company holds a lease on ten lots upon which there is a large amount of mine equipment. The new company will add to this and develop the lease.——Another feature of the spring development in the district is the number of new mills being erected and remodeled. A. L. Shepard of Chicago has just completed the third mill since the first of January. The three mills represent an investment of $100,000, and are all situated along Center creek, north of Webb City. The latest is the Corrie Cole mill, on the Beasley lease. It is a 200-ton plant and made its initial run of 50,000 lb. of zinc and 30,000 lb. of lead a few days ago. The mine is in soft ground and has been a good producer for some time. Another mill owned by Mr. Shepard is immediately north of the Corrie Cole, also of 200 tons capacity and operating on the same run of ore as that worked in the famous Kansas City-Bradford mine. The third is the Sturgis mill, which was completed a few weeks ago and has been active since.——The Lehigh Zinc Co. is building a 150-ton mill on their property at Lehigh. There are 22 acres in the lease, which is already well developed. Two shafts have been sunk, one down 85 ft., which has already penetrated 22 ft. of ore. The same company holds a ten-acre lease across the creek, on the Moler-Smith ground on which there is a 98-ft. shaft. The company holds another lease at Cottonwood Springs, where an orebody 50 ft. thick has been struck at a depth of 165 ft. ——Three new mills are being built for the sheet-ground camp, north of Webb City. Ball & Gunning have finished a 250-ton mill on the Bird Dog lease, and expect to have it in operation in a fortnight. The shaft is in sheet ground and is 225 ft. deep.——The Moark-Nemo Con. Mining Co. is erecting two 350-ton plants on the Guinn and Aylor lands. There are two 125-hp. gas engines and one Corliss compressor. Two Foust automatic jigs will be installed.——The Yellow Dog mine, north of Webb City, is sinking its third incline shaft. The new shaft will handle the ore from both the upper and lower runs. There are only two other incline shafts in the district, one being sunk on the Continental lease by the Tamagama Mining Co., in the Joplin camp, and the other already in operation in the Cave Springs camp.——The Granby Mining & Smelting Co., one of the largest in the district, is re-opening all the mines on its properties. Eight mills are already in operation and four drills are prospecting. The Gravity tailing mill and the Burress sludge mill are also operating on the Granby land. The Golden Rod, another Granby plant, is temporarily closed pending development. The third hole is being drilled and is now 70 ft. deep. One hole penetrated an ore-body 20 ft. thick.——One of the richest lead strikes made lately, was reported from the Log Cabin mine at Duenweg, at a depth of 154 ft. A number of mines in the vicinity have been operating on galena at 50 ft., but are now making preparations to sink deeper to strike the run encountered in the Log Cabin shaft.——A rich run of zinc-blende and galena was found in the Next Week mine, at Bellville, on the old Liverpool lease. The top of the run has not yet been discovered as the find was made by driving from the 96-ft. level. Enough work has been done, however, to show that the body is large and unusually rich. The ore is being cleaned on hand jigs, and some of it is in large chunks and ready for the market when taken out.——There is a great deal of activity in the camp west of Joplin. The Bull Frog mine is producing from 80 to 100 tons per week. The Grace mine has secured a lease upon 40 acres east of its own property and will begin prospecting at once. The Monitor mine, which has been closed down for some time on account of water, has installed pumping machinery and will be able to resume work in a short time.——The Spring City camp, south of Joplin, is also active. The new Delta mill is almost completed and operations will be begun as soon as the shaft is unwatered. A rich deposit of lead ore has been discovered, which the company will develop. Three drill-holes are in ore and the shaft is down to the 160-ft. level.——The Sunrise Co., in the same camp, has recently installed a crushing plant, and the past week produced 12 tons of zinc and 4000 lb. lead on four hand-jigs.

Joplin, June 15.

UTAH.

SALT LAKE COUNTY.

The Bingham Great Western Mining Co. has been incorporated to exploit a group of claims in the West Mountain district, Bingham canyon.——The Starless mill, at Bingham canyon, which was demolished last spring, will be rebuilt at once.——The Butler shaft of the Butler Liberal is in shape to start sinking. It is the intention to sink at least 50 ft., so that the extent of the orebody can be determined.

SUMMIT COUNTY.

It seems an assured fact that the Daly-West will resume in the near future.——The force at the Silver King Coalition mine and mill is slowly but steadily being increased. The King is to purchase the Jupiter holdings, and thus increase the area of its property 113 acres.——The Nelson-Queen, in the Elkhorn district, is to resume, and preparatory to extensive development has purchased new boilers, an engine, cages, and other minor equipment.——Numerous improvements are under way at the Daly Judge mill, including the building of a conveyor system. It is possible that the force at the mine will be increased, which would necessitate another shift at the mill.——It is understood preparations are being made for the resumption of work at the Keystone property in Thaynes canyon.——The final work in the cleaning up of the cave in the Ontario drain adit between shafts No. 2 and 3 was accomplished last week and now the big waterway is permanently open.

MEXICO.

The Cia. Metalúrgica y Refinadoro del Pacifico, at Fundicion, Sonora, has made its first shipment of matte to New York. The consignment was three carloads, and went to the Nicholls Copper Co.——The Mexican Exploration & Mining Co. has exercised the option which it has had for some time upon the Zapal gold mine in Mexico. The mine is one that has been worked for several years by its former owners, who are Mexicans, but who have never developed it to its full capacity. During the past three months the Mexican Exploration & Mining Co. has kept one of its engineers at the mine making examinations and assays; also supervising the sale and shipment of ores.——W. E. Bruyn has secured an option on the San Jose de Gracia mine in the Sierra Juarez district of Oaxaca, and is working the property. Power-drills have been installed. The mine and mill are connected by an aerial tramway and 3500 ft. of surface track.

Special Correspondence.

LONDON.

United Alkali Co.—Brunner, Mond & Co.—Methods of Encouraging Workmen.—Employers' Liability.

A few weeks ago I gave some particulars of the United Alkali Co., the great chemical consolidation in the North of England. This week I am able to give similar details in connection with the other great chemical firm, Brunner, Mond & Co., of Northwich and elsewhere. The chemical industry generally settles in a locality where fuel, brine, and pyrite are cheap. Northwich is in the centre of the Cheshire saltfield. There are coalfields on all sides, in Lancashire, Staffordshire, and North Wales; while Spanish pyrite is imported to Liverpool and thence by the Weaver canal. Many of the chemical works belonging to the United Alkali Co. are found in the same district, at Runcorn, Widnes, and St. Helen's. Brunner, Mond & Co. differs from the United Alkali Co. in that it is a gigantic business that has gradually grown from small beginnings, instead of being a consolidation of a great number of businesses. There is another difference as well, for the finances are managed in an entirely different manner. When the United Alkali Co. was floated, the highest possible purchase price was exacted, with the consequence that the capital is top-heavy, being very nearly £9,000,000. At the time of flotation the chemical trade was booming, and the prospective profits were quite unjustifiably figured on the basis of the current profits. So we see ordinary shares getting little or nothing nowadays, and the preference shares not forming the best of security, seeing that there are three million pounds worth of debentures in front of them. The year 1907 was a comparatively good one for the United Alkali Co., but out of £479,349 profit, the three million ordinary shares only received £56,875 dividend. Not only is this over-capitalization unsatisfactory to the shareholders, but it prevents the company from ever raising any more funds for capital extension.

As a contrast to this, the financial position of Brunner, Mond & Co. is cheerfulness itself. The total paid up capital is £2,789,650, two-thirds of which is in ordinary shares and one-third in 7% preference shares, and there are no debentures whatever. Not only so, but the company also has in hand a reserve fund of £900,000, most of which is in first-class investments. Three years ago, when it was desired to place some of the reserve fund, which then stood at one million pounds, into the business as an extension of capital, £500,000 was paid out to the general trading account and corresponding new ordinary shares issued to shareholders at par as a bonus. The profits of the company during the year ended March 31 last amounted to £740,951, which is considerably more than the yearly profit of the United Alkali Co. Of this sum £100,000 is placed to reserve, $54,980 is paid as preference dividend, and $588,861 as ordinary dividend, which is at the rate of 30% per annum. The profit for the year was a trifle less than that for the preceding year, which was £778,500, the fall being due to the increased cost of coal. Until now there has always been a regular increase in the profits. Ten years ago the profit was £367,400, which shows how the business has increased during recent years. The firm of Brunner, Mond & Co. shows its sagacity in many ways. For instance, if there is a new process which holds out considerable promise but is not likely to make immediate profits, a new company is formed to take over the entire responsibility. In this way the proved industrial and the more speculative processes are separated and the possible losses on the one are not allowed to nullify the profits of the other. Two cases in point may be mentioned. One is the Mond Nickel Co., which was formed to operate Dr. Mond's nickel process. For some years this process caused considerable anxiety and worry, and the money sunk in it would have interfered with the profits of the established chemical business. These troublous days are now over, and the nickel company is making substantial profits. The other company is the Brimsdown Lead Co., which was formed to work the Bischof white lead process. This company has still to win its success. Naturally, the shares in Brunner, Mond & Co. stand at a high premium in the market. The preference shares are of £10 denomination, and their quotation today is £17. The ordinary shares are of £1 denomination, and their present price is £5. Promoters and stockbrokers are continually urging the directors of the company to increase the nominal capital in such a way as to bring the par value of the shares more nearly to the level of their market value. The directors wisely refuse to listen to the voice of the tempter, and at any rate during the life of Sir John Brunner will never adopt any such policy. Sir John does not at all like the high valuation which the market puts on the shares, holding that a far larger margin should be allowed for fluctuations in this class of business. The firm also exhibits its shrewdness in the way of handling the workmen and in devising methods of increasing their efficiency. American readers require to be told that the English law provides many stringent rules and regulations for the proper safeguarding of the health and life of the workmen. To English readers Professor Austin's recent article in the MINING AND SCIENTIFIC PRESS advocating certain decencies in the method of treating men in reduction works seems quite an anachronism, for in this country the rules that both the master and the men have to obey are all carefully thought out already. Brunner, Mond & Co. go further than these compulsory provisions. They provide gratuitous medical advice for their employees, as well as reading-rooms and clubs. They have elaborated their own sickness and accident funds. In order to keep their men, they have inaugurated a special fund by means of which they give a bonus of 6d. in the pound to all men who stay a year with them, and 1s. to those who have been with them five years. This bonus is not actually given to the men until they leave the service of the company. The firm has organized a system of holidays for the steady workmen. As a rule workmen do not get paid for their time if they absent themselves from work, but the firm was of the opinion that if holidays were regularly arranged and paid for, the men would not absent themselves so often. In 1884 the company began to give a week's holiday in this way to all men who had been a year in service and had not missed more than ten days. In that year 43% of the men qualified for their holidays. In 1907, although they had screwed up their standard from ten days lost to two days lost, they found that 97½% of the men had qualified.

Another step of no small importance taken by the firm is the encouragement given to men to stay with them as they grow old. This firm does not believe in the "too old at forty" theory. The reason for turning attention to this matter was that the firm was investigating the probable results of the new act relating to employers' liability. This act, which came into force a year ago, places upon the employer the responsibility of all accidents and illnesses met with in the course of employment, whether there is any contributory negligence on the part of the employee or not. It became necessary therefore to study the question of accidents generally much more closely than hitherto. Some firms commenced immediately to weed out old men. Brunner, Mond & Co., before doing anything rash, made investigations and found that the percentage of accidents was highest among the young men. Between the ages of 18 and 25 there are most accidents, at the rate of 8½% per annum, and this rate gradually declines until at the age of 50 or over it is less than 2½%. These figures have confirmed the policy of the directors in keeping men in the service of the company for long periods of years. It is interesting to note that Brunner, Mond & Co. have unimportant interests in mines. They have no holdings in Spanish pyrite properties, as has the United Alkali Co. A few years ago they spent large sums of money in re-opening some of the North Wales zinc mines, but found the enterprise a wild-goose chase. The only mine actually acquired was the Trelogan, and this has unfortunately not redeemed its early promise, and is now a rather irregular producer. The Mond Nickel Co., of course, owns the properties in Canada.

JOHANNESBURG, TRANSVAAL.

Metallurgical Trials Committee.—High Mill-Duty.—Output for April. —Cost-Record Lowered.—Discoveries of Molybdenum.

Some months ago the chairman of the Rand Mines Ltd., L. Reyersbach, suggested that there should be an experimental laboratory in connection with the Rand mining industry. The idea was not taken up at the time, and the various groups have continued to carry on their experimental work independently. In consequence there has been no little loss of time and money, for often one group would commence an experiment which had been proved a failure months before by some other group. There is to be a change for the better, however, for a 'Metallurgical Trials Committee' has just been formed, and in future useless duplication of experimental work will be avoided. Nearly all the mining groups are identified with the scheme. The best known metallurgical experts on the Rand are members of the committee. Every encouragement will be given to the men at the mines to bring before the committee any inventions or any proposals they may have to offer for the improvement of industrial methods.

The declaration of the gold output for April shows that the total production of the Transvaal was 565,832 oz., valued at £2,403,500, which is a decrease compared with March of 9069 oz., valued at £38,522. The amount produced by the Rand was 543,361 oz., valued at £2,308,050. Compared with March the Rand output shows a decrease of 10,079 oz., valued at £42,815. During the month there were 8875 stamps at work in the Transvaal, and of this number 8450 were crushing on the Rand. As usual there is a large variation at the different mines in the amount of rock sorted out. Two important producers, the Langlaagte Deep and the Consolidated Langlaagte mines show that no attempt was made to sort out waste rock, the run of mine being sent to the mills to be crushed. Whether this be the best policy is a debatable point. On the other hand, at some of the mines as much as 30% and over is sorted out as waste rock. There were 74 tube-mills at work in the Transvaal during the month, and this is one reason for the very satisfactory results obtained. The Luipaard's Vlei Estate again takes the lead as far as duty per stamp is concerned. At this mill the amount crushed per 24 hr. was 9.26 tons. With a 60-stamp mill this mine was able to get through 14,720 tons for April, a most creditable result. The first position for April as regards output is held by the Simmer & Jack, with an output of 25,600 oz. and a profit of £63,658. Next on the list is the Robinson mine with an output of 25,410 oz. and a profit of £80,076. Third, is the Robinson Deep with an output of 19,461 oz. and a profit of £39,052. This is certainly a remarkable trio. The Central Administration mines establish a new record in working costs for this group. The average for the eight mines works out at 17s. 3.440d. The lowest on the list is the Robinson mine, with a cost of 12s. 9.832d. per ton. This figure establishes a record for the Rand. The highest cost of the Central Administration mines for April was that of the New Modderfontein mine, namely, 22s. 6.679d. The aggregate profit for the groups for April was £868,115, which is an increase of £3411 over March. As regards labor, there is a gain in native labor figures and a loss in Chinese. Time-expired and other wastage of natives totals 9159 against 10,290 distributed to the mines, leaving a net gain of 1131 for the month. At the end of April the number of Chinese in the employ of the mines had dwindled by 2445 compared with the end of March, leaving the total indentured labor at 24,059 men.

A large deposit of molybdenum ore has been found in the Messina district. The commercial value of molybdenum is about 5s. per pound. According to the *Zoutpansberg Review*, the outcrop occurs at irregular intervals in the form of chimneys, and consists of fibrous rock resembling ironstone and quartz, strongly impregnated with crystals of molybdenum and occasional crystals of tourmaline. The existence of tourmaline and molybdenum is here generally believed to be strong evidence of the near-by existence of tin.

Witwatersrand Deep, Transvaal.

ROSSLAND, BRITISH COLUMBIA.

South-Belt Development.—Discoveries in the Josie.—B. C. Copper and Dominion Resume.

Activity in leasing and development on the prospects in Rossland camp is proving an important factor in this district. The ground is being gone over in a much more thorough manner than in the early boom days, from the fact that the local industry has come down to a conservative basis and results are what the miners are after, and not the mere staking of a piece of ground and the selling of it, as was too often the case in the early history of the camp. The work now in progress has revealed two or three excellent veins which with proper development may become producing mines, and what is more important, will prove up the mooted South Belt, which would give hope

to the many companies that own equipped mines therein. On the Josie of the Le Roi No. 2 an 8-ft. body of copper ore has been discovered that carries, at a point over 300 ft. below their present 900-ft. level, double the metal generally contained in the ore hereabouts. While the ore-bodies in the Josie have usually been narrow, though of higher grade than those in the Le Roi or Centre Star, yet there is good reason, in the opinion of local mining men, why in depth the Josie ore should not be found in larger lodes, since in both the Centre Star and the Le Roi mines gold-copper ore is found in large deposits. The Le Roi No. 2 is one of the steady dividend-producers of this district, and from present prospects will continue to distribute profits to the shareholders for some years to come, as the management is conservative and careful.

Once more the hum of wheels and the noise of industry are to be heard in the plants of the three big copper-producers of the Boundary, the B. C. Copper and the Dominion Copper companies having followed the lead of the Boundary's principal mining company, the Granby, and resumed operation at their mines and smelters. The mining and smelting men of the Boundary were placed between Scylla and Charybdis when copper dropped to such a low figure just at a time when they had overcome a multitude of other troubles. Then labor troubles were threatening, and in order to start off with a clean sheet everything was closed down. The wage difference was settled by a commission, and the outlook was that copper would recover a few cents, and with the phantom of fixed costs pressing upon them, coupled with the fact that other big producers in the United States were putting copper on the market, to say nothing of pressure from the shareholders, it was thought best to continue operation, even on the basis of trifling profits. Granby resumed early in the year, the B. C. Copper a few weeks ago, and now the Dominion Copper Co. will soon have things in running order.

While general business interests in this district will bear a rosy appearance, the managers of the mining companies will have a season of the hardest work they have ever experienced. The watchword 'economy' will have to be ever before them, for they will have to show favorable results or some good reason why they were not obtained to satisfy those concerned. Labor and money-saving devices of many sorts will have to be adopted, and every leak that can possibly be stopped attended to. The men in charge, however, are all able and experienced, and cooperate cordially in an interchange of ideas, and everyone anticipates that the Boundary miners will succeed in digging out their low-grade ore and marketing their copper in the face of the present low price of the red metal.

It has been claimed that the Granby Consolidated could make but little over expenses owing to the low price of copper, but the best answer to this assertion is found in the dividend of 2% recently declared upon the par value of the stock outstanding, payable out of the earnings of the company, on June 13. The dividend amounts to $270,000, and is the ninth one declared by the company, the total of all dividends to date amounting to $3,238,630.

MEXICO.

Revision of Mining Law.—Conference with the Chamber of Mines.

The anti-foreign articles in the proposed revision of the mining law, mentioned in my letter of last week, continue to attract the greatest attention by all concerned. The committee of the Chamber of Mines, composed of J. L. Requeña, Salvador Calcino, Rodolfo Reyes, Carlos Robles, and Ramón Alcázar, prominent in legal and mining circles in both Mexico City and Guanajuato, had an audience with the Minister of Fomento, Olegario Molina, for consideration of the anti-foreign clauses. Lic. Riqueña acknowledged the general excellence of the proposals, expressed appreciation of the adoption of many of the suggestions made by the Chamber of Mines, but stated that for the good of the country he must object to Articles 141, 142, 143, and 144. Carlos Robles showed what foreign capital had done for the country, and also called attention to the fact that ten years ago Guanajuato was practically dead, while today it was alive and vigorous under the stimulus of foreign capital, and stated that two other old abandoned camps were being investigated by foreign capitalists, but if the new provisions were enacted into law, the inflow of capital for mining ventures would cease, and as a result the mining camps would be abandoned to the country's resources, which at best were limited. Mr. Molina replied that when the Government granted concessions it imposed conditions and the solicitor accepted or refused them, and so far there had been no objection to forming Mexican companies, but with mining companies it was different. An ordinary transfer of land put them in possession, and as it was difficult to control a person or company once in possession, it was best to make the requirement that only a Mexican company should be able to acquire the ground. The Minister further expressed himself in substance to the effect that Articles 141, 142, and 143 only reproduce the law of February 1, 1856, which requires that foreigners obtain permission from the Executive to acquire land within a zone 20 leagues wide along the frontier, but extends it to include the entire area of the frontier States and Territories as regards mining properties, this being simply a precautionary measure against renegades and adventurers. Thus the Government would hold the power to prevent their obtaining land and working out fraudulent schemes. Article 144 is new to Mexican legislation, and while it is true that by liberality toward foreigners great national progress has been attained, circumstances now have changed. The outcome of the conference was that Mr. Molina agreed to present the whole matter, with the recommendations for and against the anti-foreign articles, to the Cabinet for further consideration. It is understood that Mr. Molina still adheres strongly to the arguments in favor of the adoption of the anti-foreign clauses, and will work hard for the bill. It is possible, however, that it may never go to the Mexican Congress, as it is a measure that may be acted upon by the President as an executive order without consulting the legislative body. It may be many weeks, therefore, before final decision is reached, and the general impression is that the objectionable clauses will be greatly modified or entirely cut out.

SALT LAKE, UTAH.

Revival at Park City.—Speculation in Tintic Stocks.—Majestic Copper Co.—Garfield Smelter.—Water-Right Decision.

A marked revival, due largely to the restoration of the Ontario drainage adit, has come to the Park City district. A number of mines which had been idle have resumed operation, the latest among the larger producers being the Daly-West. The mine and mill of the latter were started up again early this week. Since the beginning of the year the production of ore has been confined almost entirely to the Daly Judge and Silver King Coalition, but neither of these mines has moved a large tonnage. The latter is preparing to operate, however, upon a much larger scale. This company has recently acquired the Jupiter group, which will be added to its already extensive holdings. Last week's shipments from the Park City district amounted to 497 tons; the Daly Judge contributed 237 and the Silver King Coalition 260 tons. Outside of Bingham, Tintic is the most active mining district in the State, and from a stock-market point of view it is by far the most attractive; at least it has been during the past two weeks, when the sales on the Salt Lake Stock & Mining Exchange aggregated close to $2,000,000. The output of ore from Tintic last week was between 50 and 60 carloads, whereas twice this amount is sent out every day by one Bingham mine, the Utah Copper. However, with the starting of the new Tintic smelter, and also of the United States Smelting Co.'s lead plant at Bingham Junction, under the modified decree of the Federal Court, the situation as far as the Tintic producer is concerned will be materally improved. It will be well along in July before either of these plants will be ready. The Uncle Sam Consolidated, which has an unexpired contract with the United States smelter, but which has been out of the market entirely since last November on account of the smelting com-

pany's troubles over adverse smelter-smoke decisions, has made temporary arrangements to ship to the American Smelting & Refining Co., and will send the latter at least 2000 tons of lead-silver ores.

Advices from the East indicate that a reorganization of the Majestic Copper Co. has been effected, and the Majestic Mines Co., which is to be its successor, has been formed. The Majestic properties are in Beaver county. The Indian Queen Consolidated, also operating in Beaver county, has recently acquired 16 additional claims, giving it possession of more than 60 in all. Electric power-equipment was recently installed at this property, where a very energetic development campaign is in progress. The Garfield Smelting Co. has been experiencing much difficulty of late in taking care of the ore sent to it by customers, due partly to mechanical troubles and to the lack of adequate furnace capacity. The sampling-mill, which has never fully come up to expectations, has caused the management much annoyance, with the result that the company has had heavy demurrage expenses. It is estimated by an official of the smelting company that there is an accumulation of between 40,000 and 50,000 tons of ore in the smelter yards at this time. While the May output of the Consolidated Mercur mine is not yet definitely known, the management asserts that it will exceed that of April, which was approximately $65,000. The mill is treating about 800 tons of ore per day. The Sunshine mine, in the Mercur district, is to be started again soon, at least as soon as necessary alterations are made in the mill. The Sunshine property was bought over a year ago, under an execution, by officials of the Consolidated Mercur, who will adopt more modern mill-methods. The Gold Mountain Consolidated Mining Co., owner of the Annie Laurie mine at Kimberly, Utah, has been experiencing some financial troubles. Application may be made for the appointment of a receiver. The Ontario Silver Mining Co., at Park City, has been given a decision in the Federal Court in a case involving the right to water from the Ontario drain adit. The Wasatch Irrigation Co. claimed that the adit tapped the flow of water from certain springs which were their source of irrigation, and consequently the irrigation company had the right to use the water after it came out of the tunnel. This view, however, was not taken by Judge John Marshall in arriving at his conclusion. Reference is made by him to the fact that the Ontario owns a considerable portion of the land underlying the drained territory, and had holdings in the lands above the mine proper. Other parts affected by the drainage was public domain, hence the irrigation concern had no rights or privileges pertaining thereto.

RENO, NEVADA.

Dedication of Mining Building of the State University. — Mackay Benefactions.

Last week was one of momentous interest to all friends of the University of Nevada, and those who have followed the history of the institution firmly believe that it also marks the beginning of an epoch of increased prosperity and greater usefulness. With the regular graduation exercises of the class of 1908 were combined the dedication of the new mining building and the unveiling of a statue of John W. Mackay. Both the building and the statue are the gifts of Clarence H. Mackay and his mother, the son and wife, respectively, of the famous pioneer of the Comstock. The new home of the Mackay School of Mines is a two-story brick building of simple architecture, done in red brick with a black border, and trimmed with Indiana limestone. The first floor is devoted to the metallurgical, assaying, and chemical laboratories; the geological museum, library, and lecture-room; the research laboratory; and the weighing and acid rooms. The second floor contains the mineralogical laboratory, the mining lecture room, offices, store rooms, and the like. The building is the design of McKim, Mead & White, of New York. The building cost $75,000, and the furnishings $12,000. The statue of John W. Mackay is of bronze, and stands directly in front of the new building. It represents a miner with his flannel shirt open at the neck, his sleeves rolled up, carrying a pick in one hand, and apparently just 'up from below.' It is the work of Gutzon H. Borglum, himself a native of Utah, but trained in the Parisian studios of Rebisso and Frémiet. Mr. Clarence Mackay and his wife were present at the exercises during the week, and entered enthusiastically into all functions, both social and academic. Nor are these gifts all Mr. Mackay has done for the University. He has agreed to furnish an endowment fund, from the proceeds of which the salaries of the instructors in the School of Mines shall be paid. He has furnished the money for beautifying the campus, according to plans prepared by McKim, Mead & White, and by Bliss & Faville, of San Francisco, and he has

By Courtesy of Nevada State Journal.

Mackay Mining Building, University of Nevada.

contributed liberally to the athletic fund of the student body. It seems especially appropriate that wealth which was drawn from the mines of the State should now be turned toward its only institution of higher learning. Mr. Mackay and his mother are to be congratulated on the spirit which prompted these benefactions. However, the people of Nevada should not lose sight of the fact that the institution of learning on the hill above Reno is a State institution, and that it is dependent upon the State of Nevada for its support and development. The School of Mines will probably always be its largest and most important department, but the others are essential to it, and to the growth of the State at large. The last session of the Legislature demonstrated that Nevada has realized, in part at least, its responsibility, and that it will stand behind the University of Nevada and the men who are devoting their time and strength to its work. No reference to the prosperity and growth of the University of Nevada would be complete without the mention of the man who has given so much of his personality and vitality to it. Joseph Edward Stubb's name will be prominently linked with its history, as will the name of George J. Young with the School of Mines, whose moving spirit he has been for many years.

BUTTE, MONTANA.

Net Earnings of Butte Companies.—Reports to County Assessor.

The principal copper producing companies of the Butte district have made their annual reports to the county assessor, showing operating expenses, gross earnings, and net proceeds during the year ending June 1, 1908. These reports are made annually for the purpose of taxation on the net earnings. Ten companies, the Boston & Montana, Anaconda, Butte & Boston, Washoe, Parrot, Trenton, Alice, North Butte, Butte Coalition, and Original, which comprise practically all of those that made a profit, show net earnings of only $4,648,261.44, against $20,263,291.81 for the year ending June 1, 1907, a decrease of $15,615,030.37. All of the Amalgamated, North Butte, and Butte Coalition (Red Metal) mines operated at full capacity for only about three months during 1907. For three months more they operated only to the extent of 35% of normal capacity, and for three months more were all, with the exception of the Boston & Montana mines, closed entirely. For the first time in many years the Parrot company shows a loss in operation, while the Washoe Copper Co. enters the list of profit-earners with $246,096 net. In previous years the Washoe earnings were more than absorbed by expenditures for construction and improvements.

The net proceeds reported for this year, compared with those of last year, are as follows:

	1908.	1907.
Boston & Montana	$1,561,065	$7,049,988
Anaconda	1,132,875	5,819,184
North Butte	1,113,647	3,271,213
Butte Coalition	71,810	1,432,760
Butte & Boston	295,604	1,249,467
Trenton	67,259	481,623
Parrot	.....	141,730
Washoe	246,096	.....
Original	159,902	663,259
Totals	$4,648,261	$20,263,291

The tonnages of ore extracted were: Boston & Montana, 967,685; Anaconda, 824,420; North Butte, 284,003; Coalition, 243,960; Trenton, 85,260; Butte & Boston, 193,830; Parrot, 57,964; Washoe, 115,620; Original, 245,853; Alice, 1500. The gross yield per ton was: Boston & Montana, $10.10; Anaconda, $9.11; North Butte, $11.36; Butte Coalition, $8.53; Trenton, $7.58; Butte & Boston, $8.31; Parrot, $7.70; Washoe, $9.11; Original, $8.20; Alice, $8.21. Cost per ton for extracting: Boston & Montana, $4.04; Anaconda, $3.96; North Butte, $3.49; Butte Coalition, $4.39; Trenton, $3.57; Butte & Boston, $3.30; Parrot, $6.57; Washoe, $4.21; Original, $4.60; Alice, $10.72. Cost of transportation: Boston & Montana, $733,352; Anaconda, $101,455; North Butte, $55,305; Butte Coalition, $53,628; Trenton, $10,318; Butte & Boston, $39,472; Parrot, $8125; Washoe, $221,881; Original, $54,766. Cost of reduction per ton: Boston & Montana, $3.06; Anaconda, $2.70; North Butte, $3.75; Butte Coalition, $3.63; Trenton, $2.39; Butte & Boston, $2.29; Parrot, $2.70; Washoe, $1.92; Original, $2.72. Paid for labor: Boston & Montana, $3,029,273; Anaconda, $2,641,282; North Butte, $990,405; Butte Coalition, $1,070,272; Trenton, $255,489; Butte & Boston, $511,711; Parrot, $240,333; Washoe, $416,-511; Original, $774,560. (In the items of cost of the North Butte and Coalition are included all mining costs.) Cost of marketing copper, including seaboard charges, refining, and selling: Boston & Montana, $617,513; Anaconda, $788,998; Trenton, $60,700; Butte & Boston, $191,385; Parrot, $51,714; Washoe, $83,108; Original, not reported. Other companies have no item of this cost, as they sell to local smelters. Paid for machinery and supplies: Boston & Montana, $3,833,-913; Anaconda, $2,846,868; North Butte, not reported; Butte Coalition, not reported; Trenton, $252,314; Butte & Boston, $571,688; Parrot, $296,676; Washoe, $292,638; Original, $356,-678. Freight on ore: Boston & Montana, $733,352; Anaconda, $101,455; North Butte, $55,305; Butte Coalition, $53,628; Trenton, $10,318; Butte & Boston, $39,472; Parrot, $8125; Washoe, $14,602; Original, $54,766. Gross proceeds: Boston & Montana, $9,775,118; Anaconda, $7,511,479; North Butte, $3,224,763; Butte Coalition, $2,080,249; Trenton, $646,-109; Butte & Boston, $1,609,763; Parrot, $457,479; Washoe, $1,052,956; Original, $1,915,994; Alice, $12,318. Total cost of production: Boston & Montana, $8,214,053; Anaconda, $6,378,604; North Butte, $2,111,115; Butte Coalition, $2,008,-438; Trenton, $578,849; Butte & Boston, $1,314,158; Parrot, $596,851; Washoe, $806,860; Original, $1,756,092; Alice, $16,085.

CRIPPLE CREEK, COLORADO.

Blue Flag Mill.—Prince Albert Development.—Shipments Improving.—Friday Leasing Co.—Iowa Girl.

The Blue Flag, at Breckenridge, has suspended operations for a period of two months. Some of the machinery in the mill recently gave out, and the cessation of operation was originally made to allow time for repairs. Now the management has decided to completely re-equip the plant with new machinery. To that end, additional electric appliances, drills, and minor equipment will be purchased. The Prince Albert Gold Mining Co., which owns a large block of land on the southeast slope of Beacon hill, at Cripple Creek, has decided to abandon the leasing system and work the property on company account. An adit will be driven, starting in the gulch which separates Grouse from Beacon hill, to strike the Prince Albert vein at a vertical depth of 600 ft. The vein is exposed for a distance of 1200 ft., and the assays average about $8 to $10. The pay-roll of the Cripple Creek district for last month is estimated to be almost $350,000. The camp is in a prosperous condition, and the volume of shipments is the largest ever known in the history of the camp. One of the gratifying features of the present output is the fact that, along with the great quantity of low-grade ore being sent out, there is also a large amount of high-grade, so that the bullion value is kept up to the level of early days.

The Friday Leasing Co., operating on the Friday claim of the White City Gold Mining Co., on Tenderfoot hill, is doing an immense amount of development work on the first or 80-ft. level in a new shaft which has been sunk during the past six months. Cross-cuts have been extended to the north side-line and another is now being run east from the shaft. Several veins have been cut recently and development work is in progress the greater portion of the time. The veins show low-grade ore and no attempt is as yet being made to ship any of it. The ore is being blocked out, and it is the intention of the management of the leasing company eventually to erect a large cyanide mill, which may be started toward the latter part of the present year. The Friday Leasing Co., which is composed chiefly of Denver men, has a bond on the property in the sum of $200,000, with a long-time lease.

Concentrates.

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

Rubber belts or gaskets may be cut much easier if the knife is wet with water, or better still with a strong solution of potash. The purer the rubber the more difficult is it to cut without wetting.

Fire damp, in America, is usually understood to mean any explosive mixture of marsh-gas and air. In England, however, the term is often applied to any mixture of gas and air, whether explosive or not.

Gravel in place is usually estimated at 3000 lb. per cubic yard, and the standard sheet iron pan, 16 in. diam. at top and 10¾ in. diam. at bottom, will hold 20 lb., hence 150 pans-full will make a cubic yard of dirt.

Thawing dynamite in hot water is poor practice, aside from the inherent danger of the method, since the nitroglycerine leaks out of the dynamite into the water and its presence is not suspected, or is forgotten, until an explosion results.

Available horse-power in a water-fall may be determined by the formula: hp.=0.1134 Hqe, in which H is the effective head, in feet, above the wheel; q the quantity of water in cubic feet per second; and e the efficiency of the wheel.

Graphite, when added to oil, increases its lubricating qualities, decreases the amount required, and allows the use of a lighter or poorer quality of oil. It is claimed that even a mixture of water and graphite may, under favorable conditions, serve as a satisfactory lubricant.

Timber superior in strength and in resistance to decay is usually found on dry, sandy, or rocky soil, on hill-sides or in relatively open forests on rolling ground, and that standing near the edges of woodlands will be found better than that from the interior of dense growths.

Transmission of power by compressed air was first proposed and tried by Denis Papin, in 1653. He proposed to use air, confined in a pipe, as a long piston transferring work to a distance. He also first conceived the idea of a pneumatic tube for transmitting parcels by air-pressure.

Specific gravity of liquids, referred to water as unity, may be calculated from the reading of the Beaumé hygrometer-scale by adding 133 to the observed degree, and dividing the sum into 143. For example, linseed oil registers 20° B. Therefore $\frac{143}{133-20}$=0.934, the actual specific gravity.

Boiler-feed water should contain no more than 5 parts in 100,000 of either sulphuric or nitric acid, otherwise serious corrosion will result. Neutralization of acid mine-waters, which always contain H_2SO_4, may not be accomplished with lime. A large part of the calcium sulphate formed remains in solution, and deposits as a particularly hard and insoluble scale in the boiler. Neutralization with soda ash, the commercial carbonate of soda, is the only safe method. This is prohibitive on account of the cost in most parts of the western United States.

Current velocity of from 2 to 3 ft. per second is ordinarily sufficient to prevent the growth of weeds or the deposition of silt in canals. The banks of a canal in firm sandy loam will not erode with a velocity of 3 to 3½ ft. per second, and in gravel or hardpan the velocity may be increased to 5 or 7 ft. per second.

Stencils may be made by cutting the desired outline or lettering out of heavy paper, and with it stencil the design on a thin sheet of zinc, using dilute hydrochloric acid for a paint. Better results will be obtained if the paper stencil is glued tightly to the zinc before the acid is applied. When the zinc has been corroded, file the edges smooth.

Amortization is the provision of a fund, made from earnings, independent of dividends, which will, in a given period, repay the original investment. A mining enterprise, in the great majority of cases, is terminable, not permanent, and should therefore return not only ordinary interest on the capital, but a further sum sufficient to repay the original capital during the life of the mine. The fairest and most systematic method of accumulating such a fund seems to be in the form of a fixed charge on the ore mined, based either upon quantity or upon the value, according to the nature of the mine.

Phosphor-bronze is a term used to define an alloy of copper, tin, and phosphorus, with or without lead. The phosphorus is placed in a perforated bell-shaped receptacle made of graphite, with a long handle. This is thrust into the molten copper. Violent ebullition occurs. From 20 to 30% of the phosphorus burns, the rest alloying with the copper. The tin is then introduced. Phosphor-bronze contains from 90 to 95% copper, 9 to 4.5% tin, and from 1 to 0.5% phosphorus. For bearings a good phosphor-bronze alloy is: copper 80, lead 10, tin 8, and 2% of a 5% phosphor-tin alloy.

Flow of water in a pipe was recently stated in this column, to be proportional to the square root of the fifth power of its diameter. Several correspondents have objected to this, and it has been advanced that the discharge varies as the square of the diameter. Our statement was based upon a formula which is an attempt to include, in a simple form, all the factors governing the flow of water in long pipes, and is, of course, only approximately true. Areas of circles vary directly as the square of the ratio of their diameters, but the discharges from straight long pipes of uniform cross section are dependent not only upon the area, but upon the length, the roughness of the interior surface, and the velocity. Vallot, a French engineer, has proposed a formula in which the discharge varies as the cube root of the eighth power of the diameter. This is closer to the truth than the square root of the fifth power, as stated by us.

Discussion.

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy.

Cyanidation in Nevada.

The Editor:

Sir—Since the appearance of Mr. Lochiel King's article in your issue of January 25, I have had an opportunity of making actual mill-runs on about 700 tons of the sulphide ores taken from the lower levels of the Combination and Mohawk mines, at Goldfield. This was selected as representative of the lower-level sulphide ores, and represented an average of what the new mill of the Goldfield Consolidated would have to treat for a long time. It consisted of a mixture of hard and soft talcose ore, the hard portions showing the sulphides very finely and evenly disseminated throughout the matrix.

This material was treated by our usual methods at the Combination mill, which was originally designed to treat oxidized ore. The results are summarized thus:

	Tons.	Gold, oz.	Per-centage.
Wet ore	506.57	.....	.....
Moisture	.....	.....	5.8
Dry ore	477.19	.....	.....
Crushed per stamp-hour	0.26	.....	.....
Average assay	.....	1.77	.....
Total gold contained	.....	844.62	.....
" recovery by amalgamation	.....	226.54	.....
Extraction by amalgamation	.....	.....	26.82
Sand concentrated	117.10	.....	.....
Concentrate produced	10.01	.....	.....
Assay of concentrate per ton	.....	14 01	.....
Slime concentrated	360.75	.....	.....
Concentrate produced	8.37	.....	.....
Assay of concentrate	.....	16.54	.....
Total gold recovered by concentration	.....	279.00	.....
Extraction by concentration	.....	.....	33.04
Sand leached by cyanide	107.29	.....	.....
Assay of sand heading	.....	0.797	.....
" " tailing	.....	0.104	.....
Extraction from sand by leaching	.....	.....	86 90
Slime treated by agitation	351.70	.....	.....
Assay of slime heading	.....	0.72	.....
" " " tailing	.....	0.13	.....
Extraction from slime	.....	.....	80 93
Total extraction by cyanidation	.....	.....	32.91
" " " amalgamation, concentration, and cyanidation	.....	.....	92.77

The stamps weigh 1200 lb. apiece, they drop 5½ in. at the rate of 108 drops per minute, and the discharge is through Tyler double-crimped 16-mesh 22-gauge wire-screen.

The average time of leaching with weak solution was 9 days; with strong solution, 5 days; so that the total time was 14 days. The weak solution contained 0.8 lb. KCy per ton and the strong 3 lb. per ton. The consumption of KCy was 1.08 lb. per ton of ore treated.

The average time of agitation was 14 hours and the strength of cyanide solution 1.5 lb. per ton; the consumption of cyanide being 1.2 lb. per ton of ore. All samples were taken at 15-ft. intervals throughout the test, at the head and tail of each step in the process, and careful screen-tests were made of all the samples and each size assayed, showing where the gold lay, before and after treatment by each process. I give a battery-discharge screen-test, so that some idea may be gained of the physical nature of the ore.

Mesh.	%
Held on 40	9.9
" " 60	14.0
" " 80	5.6
" " 100	7.9
" " 150	3.6
" " 200	1.2
Passed 200 (sand)	2.7*
" 200 (slime)	51.9*

* Determined by a rising current of water.

This test showed plainly what could be done with the inadequate facilities at the Combination mill, and also indicated what could be expected from a properly equipped plant, to treat the ore by the method outlined in the test. It is apparent that, physically, the ore lends itself readily to wet-crushing. When carrying 5.8% moisture, 57.6% passes 200 mesh when stamped through a 16-mesh screen at the battery. This shows the soft nature of the ore. Both of the conditions are inimical to dry-crushing in ball-mills, the moisture and soft material making it necessary to dry the ore, and the amount of soft material present retarding the grinding effect of the mills on the harder material. The stamp-duty is shown to be large, and the mechanical results justify the stamps. By amalgamation, a recovery of 26.82% was made, as against 4.2% shown by Mr. King, and this could have been materially improved had our plate-area been larger. A saving of 33.04% was made by concentration, this being represented by 18.4 tons of concentrate, or 3.85% of the total ore treated. It was shown that practically no extraction had occurred on the material held on a 40-mesh screen, by either amalgamation or concentration, and but 45% extraction on such material as remains on 80-mesh. It was demonstrated that all material should be ground sufficiently fine to pass 100, or 150, mesh to obtain the best results. By such fine-grinding a large increase in the gold saved by amalgamation is obtained, by reason of which the concentrate will have a much lower value, and a larger portion of the sulphide will be liberated, allowing better concentration, with a residue more free from sulphide for cyanidation. This calls for large plate-area and proper concentrating facilities, neither of which were available during the test.

In the treatment by cyanide, the same conditions affected the extraction, that is, sand coarser than 100-mesh, and fine sulphide slime, due to poor concentration. The sand finer than 80-mesh and coarser than 200-mesh represented 47.7% of the product leached, and on this product the extraction was 97.36% of the original gold content of the ore. This product between —80 and +200 mesh was such that the proper comminution for the best extraction had been reached and the free gold and sulphide liberated, allowing of the best amalgamation and concentration, and there is no reason why as good results should not be obtained on the product coarser than 80-mesh if ground sufficiently fine.

The following is a screen-test on the sand-tailing after leaching:

Mesh.	%	Gold, oz.
Held on 40	0.1	0.19
" " 60	8.8	0.14
" " 80	10.5	0.11
" " 100	20.5	0.04
" " 150	24.0	0.05
" " 200	3.2	0.05
Passed 200	32.5	0.114

Screen-test on slime treated by agitation:

Mesh.	%	Gold, oz.
Held on 100	1.4	0.06
" " 150	3.3	0.08
" " 200	1 1	0.08
Passed 200 (sand)	3.9	0.16
" 200 (slime)	90.1	0.18

On the material coarser than 200 mesh in this agitated product, an extraction of 95.77% was made from the original content of the ore, at the end of

14 hours' agitation and filter treatment. Several agitator-charges were sampled each hour during agitation, to determine the rate of solubility of the gold and the time necessary for agitation; the following is an average of results of such sampling:

Time of agitation. Hours.	Assay of pulp. Oz. gold per ton.
1	0.73
3	0.43
6	0.34
9	0.30
12	0.26
14	0.30
Extraction during agitation	58.9%

These special charges were sent to the storage-vats; the filter-charges made and treated separately. After the cake was formed the gold-bearing solution was displaced with a waste solution, carrying 0.4 lb. KCy and 6 cents gold per ton. The washing was continued with this solution for 45 minutes, with the following results:

Charge going to filter-box	0.30 oz. gold per ton
After 45 minutes washing	0.132 " " " "

Extraction in the filter-box was 23%, bringing total cyanide extraction on slime to 81.9%. While the results of the screen-tests showed what can be done with the material coarser than 200 mesh, it still leaves us with 76.78% of the total material stamped on which only 90.8% extraction has been made, but by careful concentration the same can be brought up 3.7%, making 94.5% extraction on this product with proper equipment. The deductions to be made, after considering the treatment of the ore by this method, to get the best results, are:

1. The ore to be stamped through as coarse a screen as possible to allow such material as readily forms slime, when crushed with water, to discharge as quickly as possible, and avoid sliming the harder particles. The battery-pulp to flow to classifiers for the separation of such slime and sand finer than 100 or 150 mesh; the coarser product going to the tube-mills. The total plate-area for amalgamation should be double the area ordinarily used, so as to allow of decreasing the velocity of the flow of the pulp over the plates to such a degree that the now fine sulphides will not unduly lag and retard amalgamation. Such area will also allow of some dilution (if the water applied in classification is not sufficient) to decrease the density, for, while the water may be ample for good amalgamation, as ordinarily discharged with the pulp through a 20-mesh screen, such is not the case after all the pulp has been ground to pass 150 mesh. It will then carry a large amount of fine gold in suspension unless very dilute.

2. Ample concentrating facilities should be provided, which in this case also means area, and not an intricate system of classification, for we are dealing with fine sand and slime and the concentration does not have to cover a wide range of material. With our ores the slimed sulphide does not rapidly oxidize and become suspended on the surface of the water, as is often the case with the sulphides of silver, lead, and copper.

3. Large settling area should be provided, to allow of settling the slime and de-watering to the fullest extent, so that all reducing action by the water, in which the ore has been treated up to this point, may be removed. The agitator capacity to be such that after three or four hours' agitation the pulp may be allowed to settle and the supernatant liquor decanted for precipitation and the agitation again commenced with a precipitated solution. These decantations and changes of solution to be made as many times as may be found necessary.

Such a method of procedure is made necessary by the rapid reducing-action of the ore, as shown by the figures given in the agitation test mentioned (and many others that I have made). The gold goes rapidly into solution during the first hour of treatment, and then more slowly until finally it ceases entirely at the sixth hour of agitation, negative results being obtained for the remaining eight hours of agitation. It was also shown that upon removing the solution in which the slime was agitated and washing with a precipitated solution carrying 0.4 lb. KCy per ton, the gold was dissolved almost as rapidly as during the first hour of agitation.

From the large number of experiments made along the lines of the mill-run mentioned, I have no doubt but 95 to 97% extraction can be made on these ores of a $50 value. Hence (but for the approximated 6% of concentrate, that we have on hand, still to be treated) our extractions are such that if commercially equal then the roasting of the crude ore need not be considered. And the fact being that roasting gives good results by cyanide on the roasted crude ore, the same will also hold good in the case of the concentrate that can be roasted and treated at the mill at a cost not to exceed that of treating the crude ore. The fuel consumption should be less when considering the amount of sulphur contained, as shown by analysis.

ANALYSIS OF CONCENTRATE.

	%		%
Sulphur	41.5	Lime	Trace
Iron	35.9	Magnesium	"
Copper	0.64	Alumina	2.68
Lead	Trace	Gold	0.04
Tellurium and selenium	0.25	Silver	0 01
Bismuth	0.12	Arsenic	Trace
Zinc	0 19	Antimony	0.10
Manganese	0.04	Insoluble	18.30

In the matter of cost of operation of the two methods, for comparison, I give the following data in cents per ton of ore, on a basis of 600 tons per day by the wet method of stamping, amalgamating, and concentrating, as against drying, crushing, and roasting.

Cost of stamping.—Power			$0.12
	Supplies and repairs		0.10
	Labor		0.0616
	Total		$0.2816
Amalgamation.—Supplies			$0.03
	Refining		0.011
	Labor		0.10
	Total		$0.141
Concentration.—Power			$0.022
	Supplies		0.0165
	Labor		0 0388
	Total		$0.0773
Tube-Milling.—(5 mills, each 5 by 22 ft.) 248 tons of sand.			
	Power	$0.10	(2.1 lb. pebbles per ton)
	Supplies and repairs	0.062	(4 in. silex lining once per year.)
	Labor	0.026	
	Total	$0.188	
	Equaling	0.0777	per ton stamped.

Roasting.—36 tons of concentrate at $1.25 per ton equals 7.5 cents per ton stamped.

These labor items include the services of a repair crew of four men, aside from the regular attendants.

Total cost (not including primary breaking) of preparing the ore for cyanidation is 65.26 cents per ton.

On the other hand, the cost of crushing crude ore in 'Kominuters' and roasting 600 tons per day is:

Operating 3 Kominuters.—Power		$0.0666
	Steel balls	0.0682
	Labor	0 0200
	Total	$0.1548
No data on screen and weight of liners.		
Drying the ore.—(Six 100-ton drying furnaces)		
	Power	$0.0533
	Repairs	0.03
	Fuel	0.055
	Labor	0.02
	Total	$0.1583
Roasting.—$1.25.		
Tube-milling.—(480 tons) $0.1501.		

Total cost (not including primary breaking) of preparing the ore for cyanidation is $1.7135 per ton. No account is taken here of operation and maintenance of conveying and cooling apparatus, dust-chambers, feeders, and storage. No labor is added to the repair items.

The operating cost for drying, comminuting, roasting, and tube-milling is seen to be $1.7135. For stamping, amalgamating, concentrating, and tube-milling, $0.6526. A balance in favor of the latter method of $1.0609.

When considering construction costs, there is no doubt but 100 stamps will greatly exceed the cost of three Kominuters; at the factory they only represent a small portion of the costs of the total necessary equipment in place, to complete the part of the process covered. For we have drying furnaces, Kominuters, roasting furnaces, coolers, storage-bins for feed to roasters and also tube-mills, conveyors, motor equipment of 700 hp., besides dust-chamber and stack. From the fact that the ore has been dried, twice the quantity will have to be tube-milled, making that item of installation double.

At the Golden Cycle mill, in Colorado, the dust-chamber, as nearly as I can remember, is 16 by 16 by 300 ft., with a 125-ft. concrete stack for eight Edwards furnaces. If this is necessary with the $8 to $10 Cripple Creek ores, it certainly would be with Goldfield ores assaying $50 per ton.

Against this we have 100 stamps of 1050 lb. apiece, 40 sets of amalgamating plates, 80 concentrators, five 5 by 22 ft. tube-mills, one 36-ton roasting-furnace, with dust-chamber, stack, and cooler, and finally a motor equipment of 625 horse-power.

I have confined myself to a comparison of the apparatus; not having the cost and shipping weights of the roasting machinery, hence I cannot compare the two systems by actual cost, but think that it will be found in favor of the wet-crushing method. I fully agree with Mr. King, that the gold saved by amalgamation, when fine-grinding is resorted to, could also be recovered by the subsequent cyanide treatment, without the added expense, but I am a firm believer in the millman's motto: "Get your gold as soon as you can," and there are good reasons for doing so. By estimating our ore at $50, and by making 28% extraction by amalgamation on 600 tons per day, we have $8400 daily, already in the form of bullion. The chances of a material loss are greater the longer the gold stays in the plant, and the farther it is carried, especially when it is being carried by solution. There is some small loss each time it is handled, either in the form of solution or precipitate. If simple amalgamation will decrease the value of your solutions by three or four dollars per ton, in addition to the other advantages mentioned, I think the additional expense is warranted.

As to concentration, I do not see any difficulty when concentrating after tube-milling, as one treatment serves the purpose, without the series of concentration and reductions mentioned by Mr. King. When crushing to 40 mesh such a series of concentrations and reductions would be necessary, as we have shown that practically 150 mesh is the liberation point of the free gold and sulphide. The 8% of concentrate mentioned by Mr. King probably contained a large amount of free gold, and sulphides in particles of gangue, which made the percentage of concentrate and values so high. The re-grinding of the 40-mesh sand again liberated an appreciable amount of fine sulphide, which made the series of concentrations seem necessary. Such series of reductions undoubtedly seem entirely proper to anyone treating concentrating ores, where in most cases (the value of the ore permitting) comminution and concentration by stages is the only proper treatment to avoid heavy losses by sliming. Looked at from a concentration standpoint, my suggestion, of amalgamation and concentration after tube-milling, may seem the height of folly. But to illustrate to what degree these fine sulphides can be concentrated, even with the inadequate facilities during the test, I attach the following screen-test on the concentrate produced during the mill-test mentioned:

From Sand.			From Slime.		
Mesh.	%.	Oz. gold.	Mesh.	%.	Oz. gold.
Held on 40	0.95	.....			
" " 60	0.57	15.06			
" " 80	1 05	.....			
" " 100	3.90	17.90	Held on 100	0.43	43.62
" " 150	14.25	13.18	" " 150	1.77	11.60
" " 200	13.70	12.20	" " 200	3.96	10.76
Passed 200	65.57	13.36	Passed 200	93.84	15.64

By fine-grinding and proper amalgamation, a large amount of fine gold is obtained that would otherwise be carried into the concentrate, largely increasing its value, which does not improve conditions even if it is expected to be treated on the ground, for reasons already explained, that is, the gold has to go through two or three more stages of treatment with a possibility of further loss. And as Mr. King has already explained, in the event of their being shipped to the smelter, only $19.50 is obtained for considerable gold that should have been recovered by amalgamation, sent to the Mint, and settled for at $20.67 per ounce.

The grinding to 150 mesh is also sufficient to insure the maximum liberation of the sulphides; with these ores, a better concentration can be made than would be the case if contending with a wider range of sizes of material. Treating these sulphides on the ground also removes the charge of $4.25 against $50 ore, and I think that by removing them by concentration and treating them separately, a much better extraction can be made than if they were roasted and treated with the ore. For changes in treatment can be made to suit the conditions for 36 tons of rich material that would be prohibitive when treating the whole 600 tons of crude ore, and I do not think that there can be any question that the roasted sulphides assaying $398 per ton (as per Mr. King's test) would demand

some different treatment to suit the conditions and obtain the best results, other than that given the roasted gangue. By assuming an extraction of 97.6% on such material, it will still leave $11.70 per ton in the tailing, which does not appear to be much when expressed as 2.4% loss, but appears very different when expressed as $11.70 per ton for 36 tons per day.

Before dismissing the comparison of cost and extraction, I think it well to call attention to the fact that we have been dealing with a quantity of 600 tons per day (the estimated capacity of the Consolidated new mill) at a value of $50 per ton. It is reasonably well known that a mine that produces $50 ore also produces a larger quantity of $5 ore, especially where the lode-channel is as wide and broken up as that of the Goldfield district. I might add as an indicator of what is expected to be done in the way of treatment, that the division line between 'waste dump' and 'suspense dump' of the Goldfield Consolidated Co. is about $4. The item that fixes the value of the ore to be treated is cost of mining + cost of milling + the amount of profit demanded. So we shall "come down to earth" and make a comparison on a conservative average between high-grade and low-grade, and say $15 per ton; then a difference of 8.5% extraction is equal to $1.27 per ton.

Should the cost of roasting be the only addition, I think we are very close to the margin of economy, allowing that the roasting method will give the better extraction by 8.7%—something that it cannot do. The actual difference in the best results obtained by roasting and the mill-test given is 4.8%, which equals 72c. per ton on $15, and the difference in cost between stamping, amalgamating, and concentrating on the one hand and the comminuting and roasting on the other, as I see it, is $1.19 per ton, equaling 47c. per ton in favor of the former method, without considering that much better results can be obtained, with a mill properly equipped for this method of treatment, or that the extraction obtained by roasting was on ore assaying $58.29 per ton, while those obtained in the mill-test was on ore assaying $36.50.

If, as Mr. King has reason to believe, the greater part of the gold in the low-grade sulphide ore is present as a telluride, I must say that it is remarkably docile to treatment by amalgamation and cyanide. Thus, 220 tons of the sulphide ore, of an assay value of $24.80, were treated by amalgamation and cyanide, without concentration, and gave extraction by amalgamation of 26.27 and 47.33% by cyanidation, making a total of 73.6%. This does not bear out such a supposition. And judging from the analysis of the concentrates and various tests that have been made, I should say that a very small proportion of the gold is present in the ore as a telluride. Referring to the agitation tests in Mr. King's article, where "the results were so poor that further efforts along that line were abandoned." I can say that while I do not think economical results would have been obtained without concentration, I do think that with two or three changes of solution during agitation, the results would have called for further investigation before abandonment, as the amount of H_2S evolved during agitation rapidly consumes all the free oxygen in solution, and any further extraction ceases.

Looking upon the extraction of gold from ore by cyanidation as an electrolytic process, it will be understood that the lack of oxygen to combine with the hydrogen soon causes a polarization of the solutions; in other words, giving a weak current in the wrong direction, either suspending any further extraction of the gold from the ore, or as the polarization becomes greater, precipitating gold from the solution. This reducing condition is very pronounced with the sulphide ores of this district, and mechanical means of applying oxygen is either only slightly effected, or not at all. After the first supply of oxygen (carried in by the first solution) has been exhausted, the gold goes into solution very slowly, or only as fast as the solutions absorb oxygen to combine with the hydrogen in the solutions and keep the electro-motive force in the right direction. And where long periods of time are necessary for good extraction with these ores, the time is simply the measurement of the combining rate of oxygen with the solutions and has nothing to do with the solubility of the gold. Such gold as is soluble in the cyanide solutions in the ore will go into solution at a uniform rate until exhausted, the solution being maintained in the proper condition, and the fact that the rate of extraction gets slower and slower and covers a long period of time, does not mean that the gold is less soluble, but that the current is becoming more feeble, due to polarization. I find that the quickest way to remedy this condition is to remove such inert solution, and pass the same through the zinc-boxes. This has the same effect in the short space of time it takes the solution to go through the zinc-boxes, as a great many hours of agitation with all the aeration that can be given. In short, it is easier and simpler to remove the H_2S from the solution by precipitation than to furnish oxygen for the charge to neutralize it. Hence my reason for saying that the agitation-capacity should be such as to allow of this procedure with the Goldfield ores.

Were the ores of a hard quartzose nature, making a larger proportion of sand than slime, which would allow of easy access to the solutions throughout the cake in filter-pressing, the proper treatment would be to use the Merrill system and avoid agitation entirely. By it the water or solution (in which the ore has been crushed and which has been subjected to all the reducing actions of the ore) can be removed, and the highest efficiency of the oxygen can be obtained by blowing air under pressure through the charge, facilitating the combination of it with the hydrogen. A regulation of the flow of solution through the charge at the best rate of flow, commensurate with the best results must be made and as much solution as required can be passed through the charge.

To summarize: It is my opinion that there is no Goldfield ore, so far developed, that cannot be reduced more economically by the wet method, treating and roasting the concentrate on the ground, than by roasting and cyaniding the crude ore.

A. G. Kirby.

Goldfield, Nevada, June 2.

GOLDFIELD, NEVADA.—V.

Metallurgical Development.

Written for the MINING AND SCIENTIFIC PRESS
By T. A. RICKARD.

The metallurgist waits on the miner. Until the ore is produced, the mill cannot be supplied. At Goldfield there is a good foundation for an interesting metallurgical practice because a large tonnage of rich ore is available. Already smelting, stamp-milling, cyanidation, and chlorination have been applied successfully.

No process of treatment can be used intelligently until the character of the ore is understood. The Goldfield ore posseses three dominant features: (1) high gold content, (2) the presence of tellurides as well as free gold, and (3) alunite. Owing to its richness, it has been possible to transport the product of this district to distant smelters, at Salt Lake, Denver, and San Francisco, where it forms the silicious part of a charge fed into a blast-furnace. Lead is usually the collecting medium for the precious metals, but copper is also used; although high-grade ore is rarely smelted in the copper furnaces. To the metallurgist in charge of the smelter the Goldfield ore is just so much silica needed to combine with his iron and lime in order to form a slag of suitable fusibility. The richness of the ore affects the sampling more than the actual smelting. Great care is required to obtain a true sample, and it is found necessary to pass a large proportion of a shipment through breakers and rolls before obtaining the fractional portion that is assayed. The alumina in the Goldfield ore retards the fusibility of the slag; usually there is about 7% alumina in the smelting mixture. But, on the whole, the commercial drawback to handling such rich ore is more serious than any technical difficulty; a carload of 40 tons containing $12,000 worth of gold represents a good deal of money, and it makes a great difference as to when the payment is made. The miner wants his money right away; the smelter would like to postpone payment until he gets his check from the refinery or the mint; between the date of shipment from the mine and the date when the gold and silver in the ore are available as currency, there is an interval of 60 to 90 days. Capital is tied up for three months, the miner objects to waiting, the smelter objects to loaning money even on so good a collateral as gold ore. The result is a compromise by which the miner pays his share—and sometimes more—of the interest on the suspense account.

Most mining districts begin to market their ores by shipment to the nearest smelters or custom-mills. They pay through the nose for treatment and transport, but they cannot escape this tax on their production until the reserves of ore warrant the erection of local mills. Moreover, in the early days of development it is not certain what is to be the average character of the ore and it is not possible therefore to ascertain the most suitable method of reduction. Usually a 5-stamp mill is the pioneer metallurgical unit. At Goldfield, the owners of the Combination mine were the leaders in local metallurgical research. From December 1903 to May 1905 the ore was shipped to the smelters; first it was hauled in wagons to Candelaria, a distance of 65 miles; later, on the completion of the railroad to Tonopah, it was carried thither, a distance of 30 miles. The distance was halved and time was saved, but the cost of transport remained much the same. It was decided to erect a mill at the mine. Tests were made in San Francisco and at the mine by F. L. Bosqui. It was found that crushing dry, followed by cyanidation, left some coarse gold undissolved in the tailing. Amalgamation was needed to supplement cyanidation. A small portion of the oxidized ore carried an excessive amount of acid due to decomposed sulphides. As much as 50 lb. lime per ton was added to neutralize this acid. Finally, an extraction of 90% was obtained on the oxidized ore. The sulphide ore, then unimportant, was more refractory. Pan amalgamation after roasting, concentration with oil, chlorination, and leaching, were tried in turn before it was decided to concentrate the rich gold-bearing pyrite, and cyanide the tailing from the sulphide ore.[1] When these tests had been concluded, a 10-stamp mill was built and to this plant 10 more stamps were subsequently added. The treatment of the sulphide ore is shown diagrammatically in Fig. 1, which is borrowed from Mr. Bosqui's description, already mentioned.

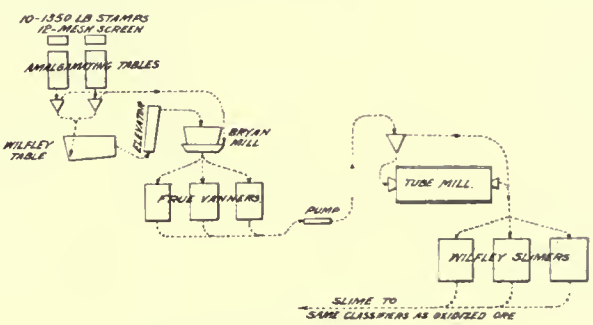


Fig. 1. Treatment of Sulphide Ore.

The Combination mill does not now impress one as a model plant, simply because it has undergone such successive additions and changes as are destructive to any unity of design, but, such as it is, this mill has solved the metallurgical problems of the district and afforded the information on which newer, larger, and prettier mills are being planned.

Before discussing the milling methods further, let us glance at the ore. It is essentially a silicified dacite enriched with gold. The altered dacite contains[2] 50% quartz, 24% kaolinite, 15% alunite, 7% pyrite, 2½% water. The alunite and kaolinite are obstacles to filtering and therefore to leaching. The alunite, being a hydrous sulphate, is destructive of cyanide and requires neutralization with lime. When the altered dacite becomes rich enough in gold to be classed as ore, it becomes more quartzose, the percentage of silica increasing from 50 to 75% or more. The ore contains pyrite (iron sulphide) in small grains, bismuthinite (bismuth sulphide) in needle-shaped steel-gray crystals, and a reddish-gray mineral resembling tetrahedrite (the gray copper of the miner).[3] The gold accompanies the gray

[1] 'Ore Treatment at the Combination Mine,' by Francis L. Bosqui. MINING AND SCIENTIFIC PRESS, October 6, 1906.
[2] 'Association of Alunite with Gold.' F. L. Ransome. *Economic Geology.* Vol. II, p. 678.

copper and the bismuthinite, the sulphides being often arranged concentrically around fragments of brecciated dacite. The native gold is rarely coarse. It occurs usually in particles so minute and so closely packed as to resemble a streak of old-gold paint. The proportion of silver to gold is as 65 to 1, so that there is a marked difference compared to Tonopah, where the silver is predominant. The Goldfield ore also contains tellurides, not in important proportion from the mineral-collector's standpoint, but enough to interest the metallurgist. Ransome mentions the occurrence of undetermined tellurides in ore from the Jumbo Extension. Lochiel M. King states[4] that, by actual analysis, he has detected calaverite, the telluride of gold, in Mohawk ore, and that he believes the greater part of the gold in the low-grade sulphide ore to be present as a telluride. The last statement is disputed by Edgar A. Collins, the former manager of the Combination mine. However, there is no doubt that tellurides exist in the ore, whether in large or small proportion remains to be proved. They constitute part of the metallurgical problem. Neither zinc nor lead minerals are noted. A little chalcopyrite has been seen in the Florence and Sandstorm mines.

The quartz, which is the predominant accessory mineral, is usually flinty in texture. Crystalline cavities are absent, but pockets of alunite are frequent. These explain the difficulty in filtering the pulp after the ore has been crushed, and the necessity for special devices in the mill. The coarseness of some of the gold aggregates explains why amalgamation is needed to supplement cyanidation. The matrix of flinty quartz encasing the finer particles of gold necessitates fine-grinding. The fineness of much of the gold justifies the use of a solvent, such as cyanide, after amalgamation. Whether roasting and dry-crushing are better than milling raw ore is a disputed question, with the preponderance of opinion in favor of the latter practice.

The Combination mill has been described in this journal by Mr. Bosqui, so it is not necessary to repeat. The same description appears in the volume entitled 'Recent Cyanide Practice.' When I went through the mill, on April 10, I noticed a broad streak of fine gold, like a band of paint, at the head of the Deister concentrating table, which receives the re-ground product from the tube-mill. This testifies to the advisability of using amalgamation. At the time of my visit the amalgamating plates in front of the stamp-batteries were blinded or covered with old vanner belts. (This was being done experimentally. In the new mill there will be thorough amalgamation before and after tube-milling.) From the battery the ore went to classifiers, the coarse passing to the tube-mill, while the fine was washed over supplementary amalgamating plates; both products went to the concentrators, one Deister and six vanners. The Deister table received the classified product, all finer than 200-mesh, from the cone-classifiers. From the vanners the pulp went to the cyanide annex. That band of gold on the concentrating table spoke eloquently for the usefulness of amalgamation. If you can save the gold at the very start, within or just outside the stamp-battery, why not do so? The metallurgist who pins his faith wholly on his cyanide annex is like the sportsman who does not mind missing with his right barrel, expecting to hit his bird with the left barrel, which is choke-bore and reaches farther. He wastes ammunition and is apt to miss his bird after all, for the farther it flies from him the more difficult it is to hit.

After the Combination mill came that of the Nevada Gold Reduction Co. This plant includes a sampler, with a capacity of 450 tons per diem, and a cyanide mill, treating 100 tons per diem. The surplus ore is sold to the smelting companies. The equipment of the mill includes 20 stamps, of 1250 lb. each, by which the ore is crushed to 12 mesh in a 0.50 to 1.25 lb. KCy solution. The pulp on issuing from the mortar goes over amalgamating plates and then to 8 Wilfley concentrators, classifying into three products, namely, concentrate, sand, and slime. The concentrate assays from $200 to $1000 per ton and is shipped to the smelters; the sand goes first to an Allis-Chalmers tube-mill, 5 by 22 ft., reducing it to a screen-size of less than 100 apertures per linear inch; from the tube the re-ground product passes over supplementary amalgamating plates and then to classifiers, the oversize from which is re-ground after going over a Wilfley. The leaching plant, which receives the pulp after the free gold and rich sulphides have been partly extracted by concentrators, includes eight vats of 22 by 5 ft. and three agitator-vats of 24 by 16 ft. Three vacuum-filters of the Butters type strain the gold-bearing solution, which is further clarified by passage through a 5-ton American filter-press, remodeled by E. S. Leaver, the superintendent of the mill.

Next in point of time, and a neighbor of the Nevada Gold Reduction Co.'s mill, is the Goldfield Cl Mill Co. This company has adopted the symbol of the chemical element chlorine as part of its corporate name. The plant is not yet in regular operation, although a trial run has been made. It is a most interesting departure and is due to the initiative of John E. Greenawalt, well known in Colorado as a chlorination expert.

The roasting furnace is a rabble roaster of the muffle type; it has a porous hearth and is heated with producer-gas manufactured from coal (coming from Helper, in Utah) enriched with crude oil (from Bakersfield, California). From this furnace the roasted ore goes to a cooling-cylinder, at the end of which it is moistened before delivery into a bin. From the bin it is transferred to large vats by means of a grab-bucket of 60 cu. ft. (nearly 3 tons) capacity, operated by a traveling electric crane. The chlorination vats are of wood, sealed by a wooden cover dipping into a launder filled with water. When silver ore is being treated 2% salt is added, before crushing, so as to get a good mixture. The leaching in the vats is done by a strong solution of chlorine

[3] I am informed later by Mr. C. D. Wilkinson that the above description is true of the Florence and Combination ores. In the Mohawk and Red Top the needle-shaped crystals do not appear and neither does the tetrahedrite. The occurrence of calaverite is still a question, as Mr. King made his determination by the ratio of gold and tellurium only; the higher-grade ore contains free gold, which will destroy this ratio.

[4] 'Cyanidation in Nevada.' Lochiel M. King. MINING AND SCIENTIFIC PRESS, January 25, 1908.

in water—7 to 8 lb. free chlorine per ton of solution. Leaching requires 3 to 4 days. The seven vats are each 22 ft. diam. and 8 ft. deep. The gold solution is withdrawn by gravity and pumped into a storage-vat and thence drawn to the precipitating-boxes, resembling the zinc-box of a cyanide plant. The precipitation of the gold is effected electrolytically, the anode being graphitized carbon and the cathode lead-shaving containing 1% zinc, the presence of the zinc hastening the corrosive action. The slime of lead, gold, and silver while still moist is mixed with flux and briquetted. The briquettes are melted in a reverberatory furnace and then refined in a cupel.

The chlorine is generated electrolytically. At first salt was obtained from Hazen, in Nevada, but it was found to contain over 5% silica, from sand blown across the dry lake; the salt now used comes from Salt Lake and costs $16.25 delivered. The solution of chlorine water is made in an absorbing tower; this consists of two sheet-iron stacks lined with glazed sewer-pipe, with cement between the pipe and the outer iron. Inside is placed a filling of hollow clay balls, each of them having eight perforations. The chlorine gas is introduced at the bottom of the stacks and water is made to trickle down from the top, the large surface thus offered facilitating absorption.

The mill has a nominal capacity of 100 tons per diem. The ore is crushed to 14 mesh and the roaster is 100 ft. long. A peculiar feature of the plant is the use of piping made of hard rubber; the pumps are actually made of it and look like cast iron until one is informed of their true composition; then they look like chocolate. Of course, iron and brass would be attacked by the hydrochloric acid, hence the use of wood in the vats and rubber in the pumps and pipes. This mill was not ready to receive custom ore at the time of my visit (in April), and yet I stated, in the opening paragraph of this article, that chlorination had been applied successfully at Goldfield. A metallurgical process is applied successfully when it yields a profit to the operator. I was referring to the use of chlorination in treating 'high-grade,' that is, stolen ore. For this purpose it is convenient, and although the percentage of extraction is not anything like that to be made by Mr. Greenawalt, it is adequate for the purposes of a 'fence,' where only 50% of the value of the gold in the stolen ore is received by the thief.

Mr. Greenawalt is an enthusiastic chlorinator and deserves success. His mill should afford a market for the rich concentrate obtained as a by-product in the cyanide plants. Mr. Greenawalt keeps some gold leaf on hand and performs a simple experiment to illustrate the greater efficiency of chlorine as a solvent compared to cyanide. In one beaker he placed a 5-lb. or 0.25% cyanide solution and in the other a 7 to 8-lb. or 0.33% chlorine solution. Dropping a fragment of leaf gold into both of these solutions, it was seen that the chlorine dissolved the metal instantly, while the cyanide had not completely eaten up the gold in an hour, a few particles of gold remaining at the bottom of the beaker, where oxygen was not available. It may be proper to point out that gold leaf does not exactly simulate the condition of gold in ore; further, cyanidation may be possible without previous roasting, but chlorination is rarely successful on raw ores. In cyanidation, the rate of solution decreases rapidly as the particles of gold increase in size, and in this respect chlorine is a more energetic solvent.

On the northwestern slope of Columbia Mtn. the Goldfield Consolidated Mines Co. is building a large stamp-mill and cyanide annex, in which will be made available all the experience obtained in the Combination mill and the other plants treating ores of similar character. At the time of my visit the concrete foundations were being laid at the rate of 100 cubic yards per day, these operations being facilitated by a crushing-plant, the rock used for concrete passing first through a Gates gyratory crusher and then through a Dodge jaw-breaker; then the broken stuff was elevated to a trommel, the oversize going to bins above a concrete-mixer and the undersize to rolls, which reduced it fine enough to make sand. This sand was an angular product well suited for making concrete. The cement comes from Iola, in Kansas. Fully 5000 cu. yd. of concrete will be required. Five thousand barrels of cement have been ordered, at a cost of $4 per bbl. delivered. A barrel holds 380 lb. On my way to the mill-site I saw a clever device used in grading for a new reservoir, to be connected with the new mill. A piece of sheet iron (an old turn-sheet) ¼ in. thick, 5 ft. wide, and 12 ft. long was being used in place of a dump-cart, as shown in the photograph (Fig. 3). The broken rock was shoveled onto this piece of sheet iron, and it was easy to roll rocks upon it (avoiding any lifting) and then to drag the load to the dump, where it swung over the edge so as to discharge itself automatically. This reservoir is to be made by using the solid rock for a back wall and half of the sides, simply plastering the surface to make it water-tight. The dimensions are 65 by 150 ft., and 15 ft. high. Steel would have cost $14,000, wooden tanks $10,500, concrete construction as outlined above will cost only $8000.[5]

On arrival at the mill-site, I found a scene of great activity, for the foundations of the ore-bins were being laid, and in the temporary office I met F. L. Bosqui, metallurgical engineer, who worked out the scheme of treatment; G. B. Shipley, the representative of the Allis-Chalmers Co., which has obtained the contract to supply the machinery; and J. B. Fleming, the mechanical engineer for the Goldfield Consolidated Mines Company.

The mill is two miles north of the mines; the ore will be transported over a railroad in 25-ton hopper-bottom cars and deliver into a bin of 850 tons capacity. The mill is expected to treat 600 tons per diem. From the bins the ore passes to a Gates gyratory crusher, which delivers it by elevator to a revolving screen (4 by 14 ft.) having 1½-in. aper-

[5]In response to a later enquiry as to the progress of the work, I am informed by Mr. J. H. Mackenzie, the general manager for the Goldfield Consolidated Mines Co., that the construction of a concrete reservoir has been abandoned owing to the time required. A water-supply is needed forthwith. So eight tanks made of redwood and 30 ft. diam. with 20-ft. staves will be placed on the reservoir site and two of the same size at the mill. The total capacity will be 1,000,000 gallons.

tures. The undersize goes to a belt-conveyor; the oversize goes to two Gates crushers and then to the belt-conveyor. This is 26 in. wide; it elevates the final product from the ore-breaker up a slope of 20° and 370 ft. long, through a Blake-Denison weighing-machine, into the sampler. From the sampler the ore is distributed by a belt running over the mill-bins, which have a capacity of 4000 tons. Suspended Challenge feeders deliver the ore into 20 mortars, each containing 5 stamps. The mortars are of the narrow Homestake pattern, but with broad bases and extra heavy, set on concrete blocks. After being crushed under the 1050-lb. stamps the ore passes over amalgamating plates made of silver-plated copper, 5 ft. wide by 16 ft. long. Thence the pulp descends to 20 double-cone classifiers, of 24-in. diam. The overflow passes directly to concentrators while the underflow goes to 6 Dorr classifiers, which thicken the pulp previous to its introduction into

Fig. 2. Blasting for Mill Foundations.

tube-mills. There are six tube-mills, each 5 by 22 ft., of the Allis-Chalmers trunnion type, lined with 4-in. silex blocks. The product from the tubes is classified in four 48-in. double cones, the overflow from which passes to 14 secondary amalgamating plates, while the underflow is returned to the tube-mills.

The slimed pulp, of which 80% will pass a 200-mesh screen, joins the overflow from the secondary amalgamating plates and proceeds to the concentrators. Concentration will be done in one stage only, namely, after tube-milling. The concentrator used will be either the suspended Frue vanner or the Deister table, and 60 machines will be required. The stream from these vanners will join the overflow from the Dorr classifiers and pass to the settling department. This consists of 16 tanks of 30 ft. diam., 12 ft. deep, provided with 16 cone-bottoms. In these tanks, by means of serial decantation, the pulp will be reduced to a consistence of 50% moisture. Then it will be transferred, partly by gravity and partly with the aid of a large centrifugal pump, into steel agitator-vats operated on the air-lift principle and known as Pachuca tanks. There will be ten of them, 15 ft. diam. and 45 ft. deep. The water overflow from the settlers will be conveyed to a series of clarifying tanks and raised to the mill-reservoir, whence it will be again put into circulation through the mill.

From the Pachuca agitators, where the pulp will be circulated in a cyanide solution for 10 to 18 hours, the material will be transferred to large reservoirs, in which it will be kept in gentle motion by means of a stirring mechanism, and from these reservoirs it will be drawn by gravity as required into the boxes of the Butters filters. There will be two of these boxes, constructed of steel and with a capacity

Fig. 3. Grading for Reservoir.

of 168 filter-leaves. After the deposition of the cake on the frames the surplus pulp will be drawn off by gravity into a large vat on a lower level. Similar vats will be provided for both water and solution, that is, the Butters plant will be operated by gravity throughout.

The solutions from the Butters filters will be clarified in three Perrin filter-presses, each having 50 frames 36 in. square. From these clarifying presses the solution will be drawn to the precipitation vats, where zinc dust will be added in accordance with the Merrill method. The precipitate will be gathered in four 30-frame Merrill presses, and the product melted direct (without acid treatment) in five Faber du Faur tilting furnaces.

The experience of several years in the Combination mill, and special experiments besides, justifies Mr. Bosqui, the consulting metallurgist to the Consolidated Company, in expecting an extraction of 95% of the gold, the silver content of the ore being negligible. The total cost of milling is to be under $2.50 per ton—a low figure, having regard to the high prices of water, power, and labor in this locality.

DIFFUSION AS A FACTOR IN ORE DEPOSITION

Written for the MINING AND SCIENTIFIC PRESS
By LEWIS T. WRIGHT.

In an interesting article by F. Lynwood Garrison, on 'Metallic Sulphides in the Tuffs of Santo Domingo' published in your issue of September 7, 1907, an occurrence of mineralization is described and his description may be summarized as follows:

In a hard tuff, difficult to work and noticeable for its absense of cracks, seams, or ducts by which an aqueous medium could travel, copper minerals are found localized in spots. These mineralized spots or streaks have the appearance of veins; but are distinctly discontinuous and erratic. The ores appear to be magmatic segregations and not veins, fracture zones, nor deposits in pre-existing cavities. The possibility of these orebodies being magmatic segregations is thereupon discussed by Mr. Garrison, but this possibility is promptly dismissed by him because the fragmentary structure of the tuff had not been destroyed by fusion, and there having been no fusion, there could have been no solution and no molecular flow or diffusion in accordance with Soret's principle of a molecular concentration caused by differences of temperature.

In the sense of Mr. Garrison's article "magmatic segregation" means a solution of metallic substances in a fused magma and the segregation or concentration of these dissolved metallic substances by their molecular flow within the solvent, according to Soret's principle, during the cooling of the magma to its freezing point. Magmatic segregation in the above sense is and has been frequently discussed, and with special emphasis by Vogt, as an explanation of certain forms of ore occurrence, and should be recognized as a distinct process from the mechanical magmatic separation or differentiation of metallic bodies entrained and mixed, but not dissolved in a fused magma—a separation acting by means of gravity, and not by Soret's principle. Also the successive crystallizations which occur in order with the cooling of the magma, and may be called chemical differentiation within a magma, are not to be confounded with a concentration by Soret's principle. Let us pause and consider what could have been the effect of a molecular flow or diffusion according to Soret's principle in connection with metallic segregations, accretions, aggregations, or concentrations of orebodies occurring in or in contact with eruptives. What in fine is 'Soret's principle'? Soret by experiment with homogeneous aqueous solutions proved that the concentration of the solute was greater in a part of such solution that was maintained cold than in a part maintained at a higher temperature. The numbers he published did not suggest that there was anything more than a slight concentration, and nothing that would amount to a 'segregation'. His number and the work of others suggested that the concentration is inversely proportional to the absolute temperatures of the hotter and colder portions of the solution, that the concentration is greater in the colder part, in proportion as the absolute temperature of the hotter is to that of the colder portion. That is to say, if in a body of solvent the upper half were maintained at a temperature of 1°C. and that of the lower half at 0°C., then the concentration of the solute in the lower half of the solution would approximate that of the upper half as 274 to 273. We have in our metallurgical experiences opportunities of observing this class of concentration of a solute in a solution.

Let us take a well settled and fluid slag from a copper-smelting furnace and let it commence to cool in a slag-bowl, and when a sufficient shell of solid slag has formed pour off the molten interior. Rejecting the top crust and the bottom of the cone in which gravimetric influences of molar separation may interfere and on assaying the side portion first-solidifying and the interior portion separately, we find a concentration of copper in the first-cooled portion similar in extent to that found by Soret. For instance as an average of a number of such trials I have found such a ratio of copper in the first-cooled slag as 1.2 to 1 in that of the last-cooled. Had the freezing point of the slag been 1100°C. or 1373° absolute, this would indicate a temperature of the interior molten slag at the time of setting of 1375°C. or 1648° absolute. Let us suppose the dissolved copper in the slag had been 0.2%, then that of the small portion first cooled would be less than 0.25%. There is a concentration, but it is trifling and totally unimportant as a molecular segregation in the sense of the cases of ore-occurrence it has been used to explain. The concentration by molecular diffusion due to difference of temperature ceases as soon as the colder portion becomes solid and this sets a sharp limit to the extent of the influence of this principle.

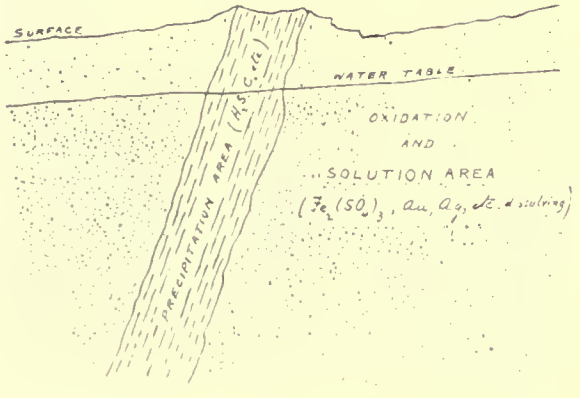
Imagine a fused rock-mass containing in solution 0.01% of a metal, say copper, at a temperature of 3000°C., and the periphery of this mass gradually cooled to its freezing point, say of 1000°C. The molecular diffusion in solution ceases so far as this periphery is concerned when it solidifies, and at that moment the pressure of the solute, in the two parts of that magma regarded as a solvent, is as 3273 to 1273, and the concentration of copper at this limiting temperature of 1273° in the periphery would be represented by about 0.026 per cent. I suggest that a consideration of the extent to which molecular diffusion by 'Soret's principle', and depending upon temperature-differences in rock magmas, can influence the formation of orebodies by concentration, shows it to be so insignificant as even to be fatal to the argument it is called upon to support.

Mr. Garrison has proposed as a basis for a theory of genesis, that would explain the one occurrence described by him in the article in question, a concentration by capillary circulation, and Courtenay De Kalb, in a more recent issue ('Diffusion as a Factor in Ore Deposition', MINING AND SCIENTIFIC PRESS, February 15, 1908), has discussed the cognate but possibly more general and frequent means of transport of minerals by means of its diffusion in aqueous solution in the following words: "Where metasomasis occurs osmotic pressure is capable without necessary movement of the solution itself, of contributing material to continue the reaction, and

that for this office saturation of the solution is not essential."

The osmotic pressure happens in solution, not only when metasomasis occurs, but always, and its effect in adjusting an equilibrium throughout the solution is brought into play whenever any change in concentration takes place in any part of the solution.

It is surprising that the transporting power of solutions at rest in which the solute will always seek to maintain the same degree of concentration or osmotic pressure throughout, has not been more discussed, in connection with ore concentrations. Van Hise in 'A Treatise on Metamorphism' discusses this transport by diffusion very clearly (pp. 82 and 637 to 639) and includes it as one of the causes of cementation. By means of diffusion or osmotic pressure solution taking place in one part of a solvent will tend to produce a uniform degree of concentration throughout the whole body of the solution, and if, at any point in the solution, there should be taking place a precipitating action, which was removing the solute from solution, the rest of the solute in



the body of the solution will tend to flow by diffusion to that point until an equilibrium of osmotic pressure is re-established, and if the precipitative action continued, the solution of the soluble substance will continue to exhaustion. Thus it is conceivable that a substance small in proportion to the containing rock may be dissolved and moreover transported to another point and there precipitated from the water which can thus act as a carrier while not moving or circulating in any manner. There is no need to conceive of any flow or stream or circulation of water as necessary for the transport of material at one time and place dissolved and at another time and place precipitated. The property of diffusion will perform this work. On the other hand, Soret's principle is a case of diffusion operating within the limits of osmotic pressure as affected by temperature-difference, and this temperature-difference is limited by the fusion point of the magma. The case suggested by Mr. De Kalb might be illustrated as in the accompanying diagram.

In a mass of rock containing iron minerals and a minute trace of gold, the water generally is taking up into solution, with the aid of dissolved oxygen, iron as ferrous and ferric sulphates, and incidentally some gold. The water filling the interstices of the rock absorbs oxygen at its upper surface, and this by diffusion penetrates more or less deeply forming iron sulphates from minerals contained in the rock. These iron sulphates tend to diffuse equally throughout the water. To the left is a sheared or fractured area or zone through which is entering hydrogen sulphide. In this area will be precipitated the iron and gold, and a fresh supply of iron and gold will continue to flow by diffusion to replace that precipitated. This action would continue until the rock in the oxidizing and solution-area was exhausted of such of its soluble content as was precipitable in the precipitating area. The precipitating area may not contain veins, fissures, cracks, seams, fracture zones, or pre-existing cavities, but nuclei or points acting as starting points of crystallization, and then, if conditions favorable to metasomasis exist, the concentration of minerals would take place.

I would offer as an extension of Mr. De Kalb's suggestion the following: Wherever from a solution, saturated or otherwise, a dissolved substance is removed by precipitation, then by the property of diffusion, without any movement of the solution itself, there will be transported fresh supplies of the substance to that part of the solution from which it is being removed by precipitation, and, if the precipitation continues, this will go on until the whole of the soluble substance has been dissolved and precipitated.

It will be appropriate while considering this matter to call attention to the well known property possessed by silica (in common with many other substances) of forming gelatinous masses or jellies while existing in what is termed the colloidal condition as distinct from crystalline forms. The jellies of colloids, even if set, allow the diffusion of dissolved salts or crystalloids to take place through their body almost as readily as this diffusion would take place through water. The colloidal jelly is a plexus of amorphous solid spread throughout water, which occupies the channels and spaces between the amorphous molecular aggregations. Free silica occurs to an enormous extent in the earth's crust, and often in the amorphous form. It should also be remembered in this connection that the amorphous forms of many substances are known to change to crystalline forms. It is conceivable therefore that much of the crystallized silica existing now as such in nature may have first been deposited or formed in the amorphous and colloidal form, and while in this colloidal form have been penetrated by other bodies in aqueous solution which bodies have crystallized or precipitated out while the silica was gelatinous, this silica afterward assuming a crystalline form. I make these observations, believing that even though flow of minerals by aqueous diffusion in rocks may not be the predominant agency by which ore deposits have been formed it nevertheless must have been frequently in operation.

Vanadium in steel increases the elastic limit, without lessening the ductility. It also enables steel to withstand more severe and continued strains. Recent tests by Richard Moldenke indicate that vanadium increases the strength of gray cast-iron 25%, while it fully doubles the strength of white-iron castings.

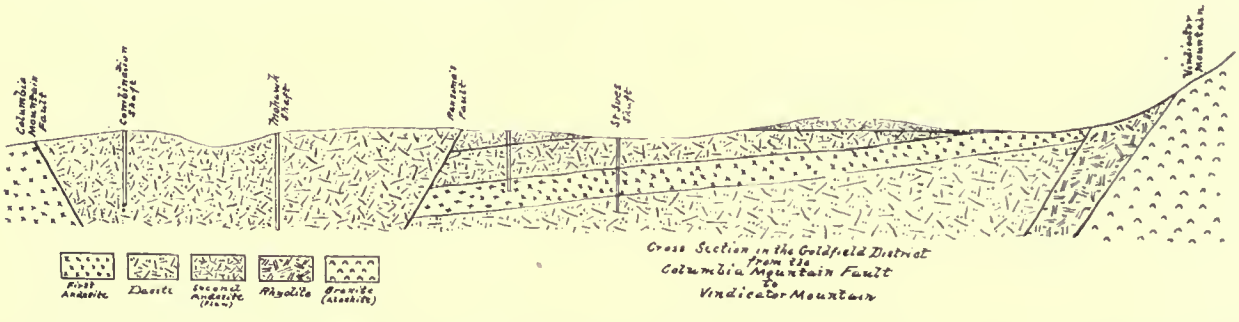
GEOLOGICAL POSSIBILITIES AT GOLDFIELD.

Written for the MINING AND SCIENTIFIC PRESS
By ARNOLD BECKER.

Any notable extension of the producing area of Goldfield (Nevada) would be welcomed, not only in the district, but throughout the country, as a matter of much commercial importance. The gold output of that small acreage covered by the Goldfield Consolidated and Florence properties has, during the past three years, been so extraordinary for a new district, that the attention of investors and operators has been very closely centred upon it, and to the neglect of a belt lying east of the Red Top, Mohawk, and Jumbo mines that seems worthy of more serious development than has yet been attempted.

The region in question differs from that of the proved belt by reason of a fault, noted by Ransome in his monograph on the geology of Goldfield; this fault strikes roughly north-south and to the west of the St. Ives and Velvet properties. West of this fault, and extending to the Columbia Mtn. fault, is an area of dacite which has not been bottomed at 600 ft., the deepest workings in the Mohawk mine and in the district. East of the fault and extending to the granite of Vindicator Mtn., is an extensive area, over part of which dacite appears at the surface. This dacite is of shallow depth—from 100 to 200 ft.—and is underlain by a sheet of the early andesite of the region. This, in turn, at depths varying, as far as I have observed, from 200 to 350 ft., is underlain by a second sheet of dacite. The importance of this fact, from a geological viewpoint, is great. The commercial possibilities can be appreciated only by those who know the relative value of dacite among the country-rocks of the Goldfield district. Of the rocks named only three need be here considered: The earlier andesite, whitish-gray, containing much hornblende and thereby readily distinguished, which is the prevailing country-rock west of the Columbia Mtn. fault, and in which no payable veins have so far been found at Goldfield, in spite of much development; the later andesite, dark gray, with phenocrysts of feldspar and with a fairly smooth cleavage; and dacite, similar chemically to the later andesite but distinguished by a rough cleavage, the presence of occasional quartz phenocrysts, and a lighter color when weathered. The first of these rocks has apparently no commercial importance whatever. The second has possibilities, as indicated in the Daisy mine at Diamondfield. The third, dacite, is the country-rock of the Mohawk, Red Top, Combination, Jumbo, and Florence mines. It is sufficiently obvious that operators at Goldfield, having before them the remarkable yield of these mines, should seek to develop veins occurring in the same country-rock and close by. That this has not been done more vigorously is doubtless due to lack of understanding of the geology of that part of the district.

In the belt with which this article particularly deals, several properties have yielded pay-ore, some of it rich, from veins that continue downward strongly as far as developed—but always, with one exception, from near the surface. Among these properties are the St. Ives, Velvet, Blue Bell, Blue Bull, North Star, and Cimmaron. Always the ore ceased, or nearly so, as the underlying andesite was approached. The exception is the St. Ives, where both the mine and lease shafts have penetrated the lower dacite, wherein, I am credibly informed, high-grade ore has again been found. This is the sole evidence, so far, that this lower dacite sheet is of the same character as that of the Mohawk-Florence belt; but it would seem sufficiently good evidence to encourage owners of neighboring claims covering strong veins to develop deeper into country that is favorable. Heretofore, operations have generally ceased as surface ore failed. In some cases, large sums have been spent in developing veins within the andesite sheet at depths of from 200 to 300 ft. with entirely negative results. A like expenditure, at a depth of 500 ft. might possibly have developed good mines.



The dacite of the Goldfield district is later than the first andesite and appears as intrusive sheets, lying rather flat and presumably following lines of weakness. Ransome notes a single such sheet, which appears at the surface, and the underlying first andesite. The lower dacite sheet does not come to the surface anywhere, but is shown in several shafts; the most westerly of these being the St. Ives and the most easterly the Old Kentuck, near Vindicator Mtn. How thick this lower sheet may be, there is as yet no evidence; but that it is of the same origin as the upper sheet, thrown off from the same more or less vertical intrusion, I can see no good reason to doubt. It follows, logically, that there may be several such sheets separated by the older country-rock. It also follows that if Ransome's north-south fault is normal, as it probably is, the first andesite of the St. Ives will be found to underlie the dacite of the Mohawk and Florence mines at a depth yet to be determined. In such event, there will be consolation in the fact that a lower sheet of dacite is known to exist and that all the evidence shows the veins to continue uninterruptedly through these variations of country-rock.

MICHIGAN COPPER MINING METHODS.

Written for the MINING AND SCIENTIFIC PRESS
By LEE FRASER.

Throughout this region different systems of mining prevail, in accordance with the dictates of necessity and circumstance. In the great majority of properties the mining companies hold the land upon which the vein outcrops, which expedites exploitation, for the lodes can be worked directly from the surface by a system of incline shafts. But, in other cases, as in that of the Tamarack and the Allouez, it was necessary to sink shafts, vertical in the case of the Tamarack, and varying only slightly from the perpendicular in the Allouez mine, until the lode is reached, when the shaft turns with the lode.

It is impossible to state the aggregate length of the workings in the copper lodes of this district. In many places cross-cuts and drifts honeycomb the vein to depths of 3000 to 5000 ft. It is almost useless to try to convey any impression of the great amount of ore that has been mined. To say that if all the ore were made into a tower 10 ft. square it would extend into the air a distance of 650 miles, and perhaps endanger the equilibrium of the earth, would leave one as much in ignorance as before. Or if it were said that the copper produced from the Lake mines would conveniently connect all the principal planets in a telephone system, with enough left over to make a girdle for the earth, we would still be unable to appreciate how much copper had been produced.

The Tamarack mine holds the distinction of being the deepest mine in the world, and is the 'deep level' of the Michigan copper country. There are five shafts on the Tamarack property, two of which are practically idle. No. 3 shaft is about 5300 ft. deep, intercepting the lode at a vertical depth of 4185 ft. No. 5 shaft is a close second at about 5250 ft., and cuts the lode at a depth of 4662 ft. No. 1 shaft, that has been idle in consequence of a fire that has been burning in the underground workings since January 1, 1906, will probably never be re-opened, since movement of the ground has so badly disturbed the shaft that it would require an immense amount of time and money to again put it into service. This shaft cuts the conglomerate at a depth of 2270 ft. and reaches downward a total distance of 3409 ft. No. 2 shaft has undergone extensive repairs during the past year and is now producing ore. It was found that the shaft had been drawn out of line by the crushing of the rock, necessitating re-timbering from top to bottom, many of the old timbers having to be replaced by new ones. The pressure of this moving ground is sufficient to break and twist huge timbers as if they were toothpicks. Even shaft-timbers of the largest dimension are broken and twisted into grotesque shapes. On the other hand, timbers have been compressed from 30 in. diam. to less than 10 in., in which condition they are as hard as flint, and defy the attacks of a saw or axe. Among mine engineering achievements the deep-level shafts of the Tamarack, and the Red Jacket shaft of the Calumet & Hecla, take a high rank. The Red Jacket shaft measures 14½ by 24½ ft. between timbers, is divided into six compartments, and extends 4900 ft. into the bowels of the earth. It is one of the largest, deepest, and most expensively equipped shafts in the world, but the shafts of the Tamarack are deeper, although not so large, No. 5 measuring 27 by 7 ft., inside timbers. Some inconvenience has been occasioned in the Calumet & Hecla by creeps and other movements of the country rock, but so far the Tamarack shafts have remained intact.

The lode in the Tamarack is reached by a system of cross-cuts driven through the country rock at intervals varying from 60 to 120 ft. down the shaft. As the work is carried deeper this necessitates much expense and labor. At present an incline shaft is being planned to be sunk parallel to the lode at a distance of 600 or 700 ft. in the foot-wall. The Osceola amygdaloid, which parallels the bed of conglomerate, can thus be worked profitably if desired. The expense of mining in the Tamarack has increased along with the opening of the deeper levels, but it is hoped that much labor and expense will be saved by abolishing the long hauls through cross-cuts. The conglomerate is usually heavy ground and requires timbering at every stage for the protection of the workmen, adding a great but unavoidable expense, for it is estimated that from 8,000,000 to 10,000,000 ft. of timber go into the mines annually.

A serious problem, which will require much consideration as the mines become deeper, is ventilation and the reduction of the temperature. In the Comstock mines the temperature often rises to 150°F., but in the Lake Superior mines the high temperatures are due entirely to depth, increasing 1°F. with every descent of 212 ft. The rock temperature now stands at about 78°F. in the lowest levels. The air is cooled by powerful fans, but these will soon prove insufficient to maintain a temperature in which the miners can work. The method of mining in the Tamarack consists generally of cross-cuts driven in from the shaft at right angles to the drift. The drift is being pushed forward on each side of the cross-cut while the ground is opened up by the 'back stoping' method, characteristic of this region. The raises are usually carried to the levels above when the work is begun on either lower corner of the block of ground which is left standing. Midway between the longer levels sub-levels or intermediate levels are driven, which present more working surface and open up more ground. The upper block of rock is taken down first, while the stope is filled with loose rock, which forms the most stable support for the hanging wall. The rock is then trammed out to the end of the level and dumped into chutes, from which it is carried to the shaft and thence to the surface. Endless-rope haulages are used whenever practicable. In some of the deeper levels the ore must be taken a distance of nearly a mile and a half before it reaches the surface.

The Calumet & Hecla encounters the same difficulties in mining as are met in the Tamarack. In both mines the ground is heavy and dangerous if left unprotected for any length of time. But it is singular to note that in both mines the death rate from accident to miners is comparatively small, and its

insignificance is marked by comparison with the deaths in coal mines due to loose unprotected ground.

One system, fast being supplanted by a newer and less expensive method, similar to that used at the Tamarack, is the square-set system. The sets are put up directly the ground is opened, but because of the enormous pressures exerted upon them are soon crushed, but not before the ore has been removed. A great amount of timber is used annually in this manner, but as in the Tamarack, the use of heavy supports are unavoidable, 20,000,000 to 30,000,000 ft. of timber are consumed every year in the underground workings. The square-set system is being

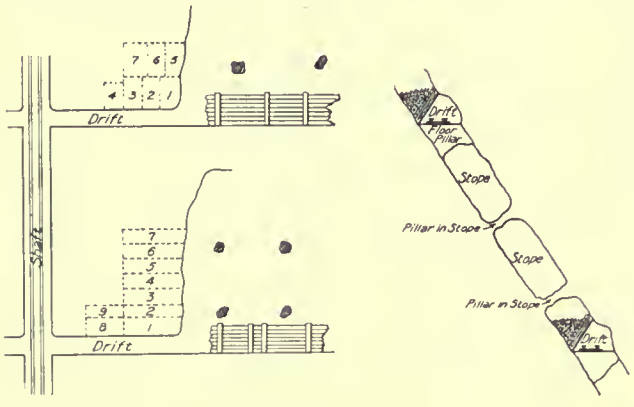


Fig. 1.

abandoned in favor of hardwood stulls, which are placed beneath the weak sections of the hanging wall.

The underground workings of the Calumet & Hecla are perhaps the most extensive of any mine in the world. The entire mine has twenty-one shafts, two of which are out of commission and four permanently abandoned. The strike of the lode averages N.39°E., while the dip is approximately 37° 30′. The conglomerate for two miles along the outcrop

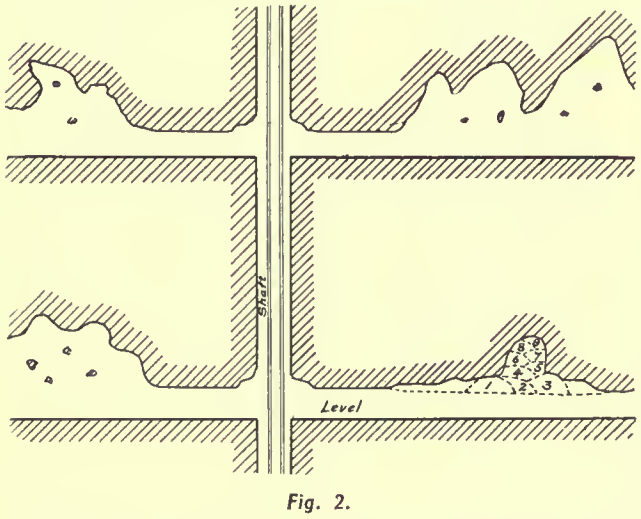


Fig. 2.

is opened by eleven inclined shafts and the six-compartment Red Jacket or Whiting shaft, while 730 ft. to the east of the conglomerate five shafts are sunk on the Osceola amygdaloid, and still farther east three more upon the Kearsarge lode. The workings of the conglomerate lode are the oldest, comprising more than 200 miles of shafts, drifts, winzes, and gang-ways. The mine is opened ahead for eight years' work. The shafts running parallel to the lode and dipping 37° 30′ are sunk to great depths. No. 4, Calumet, a single-compartment shaft, is sunk parallel to the lode a distance of 8100 ft., while a winze 190 ft. long at the bottom prolongs the depth to 8290 ft. No. 7 and 8, Hecla, both one-compartment shafts, are at present about 6300 ft. deep, and can be sunk 2700 ft. before reaching the Tamarack boundary. The mine has suffered severely in the past from underground fires, caused by the ignition of the old rotting timbers in the abandoned workings. Every possible precaution is now being taken to prevent similar occurrences in the future, by the maintenance of a fire-signal system, shaft sprinkling, fireproofing the timber, and the establishing of fire stations, equipped with chemical fire-extinguishing apparatus, while water pipes and hydrants are scattered throughout the workings. The mines are connected throughout with a telephone system, so complete that communication may be had, if required, with Chicago or New York from the bottom levels, five thousand feet underground.

The practice of mining the amygdaloid lodes does

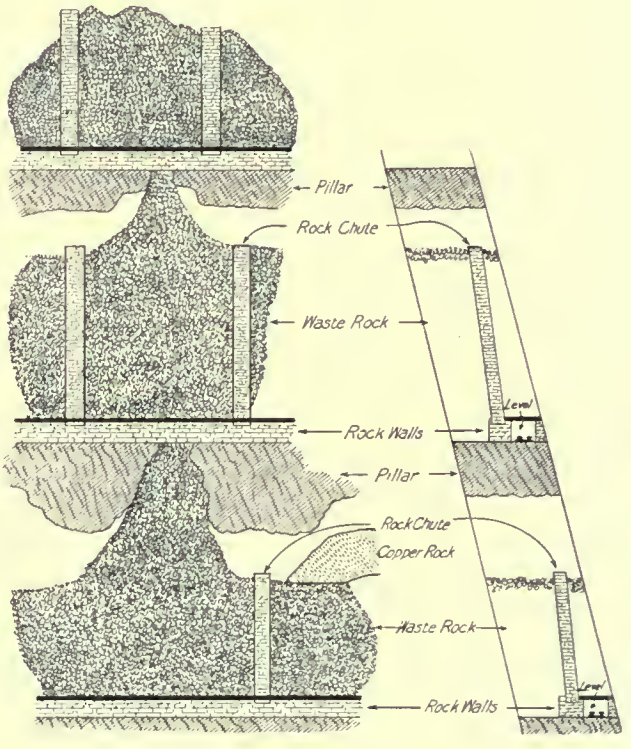


Fig. 3.

not involve the expense and dangers attendant upon mining the conglomerate, for in the Quincy, which, next to the Calumet & Hecla and Tamarack mines, is the deepest in the district, ground may be left unprotected with impunity. The practice throughout the Mohawk, Ahmeek, Allouez, Kearsarge, Wolverine, South Kearsarge, Centennial, Osceola, Franklin, Isle Royale, and Atlantic, all of which are opened upon some one of the amygdaloid veins, is identical with but few exceptions, the main differences being in the protection of the hanging above the drifts. Pillars are left in every case, the lean ore forming the pillars. The ground is brought down in successive cuts, as shown in Fig. 1 and 2. Compressed air is used throughout as the power underground for running drills, for rope haulage engines, and other purposes.

Among the mines on the amygdaloid one of the most noteworthy is the Quincy, originally opened

upon the Quincy, but now working the rich Pewabic lode. The workings extend from north to south 8000 ft., and several hundred feet upon each side, but there still remains untouched a tract of land extending about 5000 ft. north from the present workings. The continuity of the workings is broken by the Franklin mine and the Franklin Junior, lying between the two most northerly shafts of the Quincy and surrounded upon three sides by the lands of that company. The old Franklin mine seems to have approached a condition of exhaustion, but it possesses a remarkable vitality. Three hundred tons of ore are hoisted daily from the old workings. The Junior mine, working the Allouez conglomerate, maintains a production of about 1200 tons per diem. The grade of the ore is so poor that the only possibility of success is in the maintenance of a large output. Other lodes are included in the property. The management is now striving to find the Kearsarge amygdaloid, the discovery of which will greatly enhance the value of the mine, provided, of course, the copper content be sufficient to warrant opening the vein. The workings of the Quincy extend to a depth of 3000 ft. below the mean water-level of Portage lake. No. 2 shaft extends 5289 ft. from surface to the 61st level, this being next in depth to the Tamarack and the Calumet & Hecla. No. 7, the southernmost shaft, is remarkable for the rapidity with which it was sunk through hard refractory rock, the total time of sinking 4000 ft. being only 18 months. Five working-faces were constantly maintained, sinking and raising being carried on simultaneously, the shaft being sunk in close proximity to the old workings so that easy access could be obtained. The line of the shaft is a catenary curve, between 53 and 37½°, a depth of 5162 ft., nearly a mile. The Quincy mine is one of the best equipped of any operating on the Lake at the present time. The facilities for handling ore are so excellent that the managers of other companies are adopting Quincy methods with alterations and minor improvements. The principal item of expense to be considered in all the mines is the handling of a great quantity of rock at low cost. The mine has been provided with electric power and motors haul the three-ton cars to the shafts where the ore is dumped into 400-ton bins, so situated in the hanging wall as to dump directly into the waiting skips, thus avoiding delay and increasing the hoisting efficiency as much as 25 to 30%. Every effort is being made to place the mine in a healthy condition. The Quincy is troubled by air-blasts caused by the falling and settling of rock in the many miles of old abandoned workings. The falling rock causes compression of the air in other parts of the mine, and sometimes the shock of the fall and the compression is sufficient to cause a miniature earthquake that may be felt for several miles around. The disturbance comes without warning, at times killing or injuring the workmen.

Rock-Walled Gangway, Baltic Mine.

In the case of the Tamarack a perpendicular shaft intercepts the lode, but on the other hand the Allouez company sunk a shaft in the southeast corner of its property, which starts from the surface with an angle of 75° from the horizontal, but soon changes to 80° until it reaches a depth of 1435 ft. It then curves to an angle of 60°, cutting the lode at 1480 ft., and finally flattens to 38½° at the third level, thence running in the foot-wall, parallel with the lode at a short distance from it. This is a great improvement over the method adopted at the Tamarack, as the cutting of expensive cross-cuts is obviated. But it must be remembered that the Tamarack is the pioneer in deep-level mining of this nature, and the difficulties overcome were enormous. It is doubtful too whether a shaft resembling that of the Allouez would have been feasible with such a

deep property as the Tamarack. By sinking a shaft parallel and at a short distance from the lode, as proposed, the Tamarack will follow the Allouez practice to a great extent.

The methods of mining pursued in the mines of the Copper Range Consolidated differ radically from those found elsewhere in the district, and are patterned to some extent after the practice in the nearby iron mines of the upper peninsula. In the Champion, Trimountain, and Baltic mines, which are held by the Consolidated company, a system known as the 'dry wall,' or 'rock wall' (Fig. 3), has been found to give satisfactory results. The amygdaloid in these mines is not uniformly wide, the maximum being 60 ft., while oftentimes the foot and hanging walls are taken down for their copper content. The lode dips at an angle of 70°, much steeper than the others mines in the district. It flattens out toward the north, being at the Keweenaw mine only 26°. The steepness of the lode has made possible the adoption and successful operation of the rock-wall system. The rock is sorted underground, the poor rock being rejected and stowed behind. As the stopes advance upward circular rock-chutes are built up with the upper rock, down which the copper ore is thrown. Each ore-mill terminates on a level through which ore is trammed to the shaft. The method, like all innovations, was first ridiculed, but is now being adopted wherever practicable. These three mines are now in their infancy, the deepest shaft being less than 1500 ft., and as yet they have not reached their maximum production. From present indications it is safe to suppose that the members of this copper-range triumvirate will in time become the best amygdaloid mines in the district.

Tellurium in cupellation of the lead buttons containing that metal, according to Sydney W. Smith, in a contribution to the Institution of Mining & Metallurgy, results in a weakening of the surface tension of the molten metal. Cupel absorption is due to this effect of tellurium in assisting the general tendency of the film of litharge in the same direction, the result being that the molten metal tends to 'wet' the sides of the cupel. If the amount of lead is insufficient, small portions of metal become detached and either pass into the cupel or leave minute beads. If tellurium, being less easily oxidizable than lead, especially at high temperatures, remains in sufficient amount toward the end of cupellation, complete absorption may occur. Complete absorption and sub-division are entirely the result of insufficient lead. Bone-ash cupels show a greater tendency to become 'wetted,' giving rise to subdivision, than patent cupels. Silver protects gold by acting as a diluent during the cupellation of buttons containing tellurium. Absorption-loss, due to the presence of tellurium, is a function of the temperature of cupellation. During cupellation tellurium is oxidized to the dioxide TeO_2.

Coal production in France is shown by recent statistics to be only one-fifth that of Germany, one-seventh of that of Great Britain, and less than one-tenth of the production of the United States.

A NOVEL BUCKET ELEVATOR.

Written for the MINING AND SCIENTIFIC PRESS
By P. R. WHITMAN.

Two bucket elevators recently installed in the mill at Concheño, Chihuahua, while not being original, possess uncommon features. The two elevators are placed side by side, have 12-in. 8-ply belts, 7 by 12-in. buckets spaced 26 in.; head and boot pulleys 24 in. diam. The two head-shafts meet in a male and female connection, inside a loose pulley, on either side of which is a tight pulley. Thus the belt can be shifted from the loose pulley to either tight pulley, to drive one or the other elevator as desired. This arrangement has given no trouble whatever, and the feed can be shifted from one to the other without stopping the mill. The mill-flow is from 60 stamps. The belt travel is 380 ft. per minute, which gives a clean discharge. The feature which has given the greatest satisfaction is the moveable boot, hinged at the back end, entirely independent of the housing, and serving as a tightener. This entirely obviates trouble with loose and slipping belts, the attendant annoyance of hanging up the elevator, and the difficulty of having the bucket-lips catch on the bottom of the boot. By the use of slotted bolt-holes in the hinges, the axis of the boot-pulley can be shifted in two planes, thus permitting an adjustment that will cause the belt to run true, both at the top and the bottom. The feed is at the back, doing away with splash, as the buckets and pulp are moving in the same direction and with about equal velocity. The elevators lean 3 in. per vertical foot, and lift 30 ft. This was simply a detail of convenience in construction. If set perpendicularly there would be less wear on the housing from dripping, and the discharge would be equally good at the same speed of belt. The moveable boot is a great advantage, the merit of which will appeal to mill-men.

Metamorphism from combustion of oils in the bituminous rocks of California is a common phenomenon. The high temperature thus produced has converted many shales into red or rose-colored porcelain-like strata, and at times has rendered them scoriaceous like vesicular lava, or clinker. The *Journal of Geology* says that the resemblance of the products to those of volcanoes and the existence of centres like solfataras where the process of burning has been going on during the last half-century, has given rise to the statement that there were living volcanic vents in Santa Barbara county. These burned shales have been encountered down to depths of 1040 ft. in oil-well drilling. At one place fragments of such material in bedded deposits of Pleistocene age show that metamorphism of this type has been going on in remote times.

Filling of mine workings by waste flushed into the open chambers is practised at the Saarbrueken collieries, which are operated by the Prussian Government. The material used for filling consists of waste from the washeries, ashes from the boiler-plant, and other refuse. The method has given great satisfaction, but the long-wall method of mining is being substituted for other economic reasons.

BURNING LIQUID FUEL WITHOUT STEAM OR COMPRESSED AIR.

Written for the MINING AND SCIENTIFIC PRESS
By ROBERT SCHORR.

In view of the great economic results that are being obtained in European countries by the burning of oil and oil-residues under boilers and in metallurgical furnaces without employing steam or compressed air as an atomizing agent, it is surprising that the most eminent producer of liquid fuel, the United States, should have given this subject but little attention. About ten years ago the first large installations of this character were made by Koerting Bros. of Germany, on a number of warships attached to the Russian Black Sea fleet. The extremely successful performances recorded there, both from a commercial and engineering point of view, attracted widespread attention, and they led to the rapid introduction of this apparatus into almost all European navies, and also into many industrial plants where liquid fuel is being used. Among the vessels sailing from San Francisco, the Toyo Kisen Kaisha's *Sapo Maru* employs the Koerting system, using a California asphaltic oil of 16 to 17° B. gravity. This is probably the first attempt in that direction with our oils, and for that reason is of peculiar interest.

Those familiar with the burning of crude oil know that from 3 to 16% of the boiler-efficiency is consumed in the atomizing of the oil with steam or compressed air. This is equal to from 0.5 to 2 lb. steam for every pound of oil burned. Under forced conditions, as frequently met in locomotive and marine practice, somewhat better results are possible. During the Hohenstein boiler-test made by the Bureau of Engineering of the U. S. Navy, 4.2% was used on an average. Carefully adjusted burners in stationary plants will require about 5%, but ordinarily it will not be safe to figure as low as this. An additional waste of energy results in the furnace itself as the injected steam is leaving with a temperature equal to the temperature of the flue-gases. This loss will vary considerably, being governed by the original temperature of the steam in the burner, and by the temperature of the flue-gases. As the specific heat of steam is approximately 0.5, every 100° of difference between the temperatures of the steam and the waste-gases requires an expenditure of 50 B.T.U. per pound. Saturated steam at 90 lb. pressure has a temperature of 320° F., and it contains 1178 B.T.U. The 50 B.T.U. are equal to over 4% of this. Taking the flue-gases to be at 620° F., there will be 150 B.T.U. used for superheating, or about 13% of all the heat carried in the amount of steam used for atomizing. If the burner requires, for instance, 8% of the total steam raised, an additional $10.08 \times 0.13 = 1.04\%$ are accounted for in the steam escaping with the furnace gases.

The use of compressed air in place of steam frequently assures a saving, if the exhaust-steam from the compressor-engine be condensed or utilized otherwise, and if the air be thoroughly pre-heated at the burner. It gives a steady and reliable flame, while wet steam is apt to cause occasional troubles. A drawback, however, is the increased first cost, and also the danger of breakdowns. The air-compressor installation permits of a close check upon the actual work expended, but the great variance of opinion in regard to the amount of pressure best suited to the purpose, shows its bearing upon the data obtained in practice. Although air-compressors are being used extensively in connection with oil-burners on vessels sailing from San Francisco, but little definite information has been available as to the relative economies. The pressure employed ranges mostly from 20 to 30 lb., and the size of the compressor is generally based upon data obtained by experiments made with various types of burners at the Western Sugar Refinery in San Francisco. These showed that about one cubic foot of free air is required for every pound of water evaporated from and at 212°F. To compress one cubic foot of free air per minute adiabatically up to 20 lb. requires 0.0628 theoretical horse-power. To economize in first cost and in floor-space, as a rule, a direct steam-driven (straight-line) air-compressor is preferred. Assuming the efficiency of its steam end to be 90%, and of the compressor with the pipe-system to be 80%, we have a combined mechanical efficiency of 72%. Every cubic foot of free air will require then, $0.0628 \div 0.72 = 0.087$ actual cylinder horse-power. This figure clearly illustrates the importance of utilizing the engine-exhaust. The thermal efficiency of the steam-engine driving a medium sized air-compressor requiring, say, from 80 to 150 hp. will rarely exceed 9%, corresponding with a supply of 28,300 B.T.U. per hp.-hr. Adding to this approximately 7% for the condenser work, we get 30,300 B.T.U. Now, $30,300 \times 0.087 = 2636$ B.T.U. have to be expanded for 60 cu. ft. free air, furnished in the hour at a pressure of 20 lb. to correspond with the evaporation of 60 lb. water from and at 212°F. The heat equivalent of the same is 965.7 B.T.U. $\times 60 = 57,942$ B.T.U., and the 2636 B.T.U. form about 4½% of this amount. Consequently, 4½% of all steam raised is required to furnish compressed air for oil-atomizing. If we assume an evaporation of 13.6 lb. water, from and at 212° F., per one pound of California crude oil (a boiler efficiency of about 70%) 13.6 cu. ft. free air is required for one pound of oil, or less than 0.25 cu. ft. free air per minute for every pound of oil burned in the hour.

The data published in the report on the tests made with the oil system of the *Mariposa* in 1902 are not correct, and they do not agree with the tabulated items. An average of 3.9 cu. ft. free air per pound of water evaporated from and at 212° F. is given. As one pound of oil evaporated 13.53 lb. water from and at 212° F., about 0.86 cu. ft. free air per minute would have been used for every pound of oil burned in the hour, or almost four times as much as in our investigation. The tables, however, indicate that on an average 3719 lb. oil were burned in the hour. The 22¼ by 18 in. air-compressor was running at 60 r.p.m. Its figured capacity at this speed is about 1000 cu. ft. free air, and based on a volumetric efficiency of 90%, its actual output amounted to 900 cu. ft. The resulting requirement was then 900 divided by 3719, or about a quarter of a cubic foot of

free air per minute for each pound of oil burned in the hour, or the same as at the Western Sugar Refinery.

Granting that better results are possible, it is quite probable that most of our oil-burning furnaces are considerably more wasteful. In all arrangements, whether steam or compressed air be used or not, the amount of energy necessary to operate the oil-pumps and to heat the oil remains about the same. From 40 to 60 B.T.U. are required for this duty, with oil heated to about 130°F. Under given conditions, the exact pump-work can be readily ascertained, and also the amount of heat supplied to the oil. Its specific heat varies from 0.41 to 0.48. In the Koerting system no steam or compressed air is used to break up the oil into minute particles. An interesting phenomenon is utilized, which will be fully understood by studying Franz E. Junge's valuable contributions, 'Technical Aspects of Oil-fuel,' in the October, November, and December issues of the journal *Power*, 1907.

At high pressures the boiling-temperatures of all hydro-carbons and their mixtures are shifted higher up. In other words, "with rising temperature of the oils the pressure has to be increased to prevent boiling or self-ignition." The rate of evaporation at various temperatures is also clearly pictured in Mr. Junge's article for all classes of commercial liquid fuels, and the diagrams show, for instance, that American petroleum is completely gasified at 400°C. (752°F.).

In the Koerting system no effort is being made to obtain a straight gas, but the oil, after leaving the pumps, is superheated to 240 to 300°F., and kept under the corresponding pressure. A portion of the oil is gasified; the percentage of evaporation at the same temperature, however, will vary immensely with the class of oil. The superheated oil is delivered to the burners under a pressure of from 35 to 75 lb. The burners are either one or more of the Koerting's well known centrifugal spray-nozzles housed in a cast-iron chamber, which is provided with air-intake regulators. The requirement of energy for every pound of oil burned varies from 0.7 to 1⅛% of all useful work performed. The oil-pumps and the preliminary heaters require, as stated before, 40 to 60 B.T.U. The further superheating by 100 to 170°F., and a little more pump work, require additional 50 to 90 B.T.U. The limits range, consequently, between a grand total of 90 B.T.U. and 150 B.T.U. In view of the complex character and unequal behavior of various oils, and also in view of the multitude of boiler and furnace designs, it is impossible to lay down definite data.

Dynamite has been substituted for black-powder by the Pittsburg Coal Co. in its 54 mines. The initial temperature of the gases resulting from the detonation of dynamite is much higher than that of the gases produced in exploding black-powder, but the greater suddenness of the reaction and the enormous expansive effect, results in displacing the surrounding atmosphere without mixing with it until the temperature has become reduced through expansion to limits relatively safer for use in coal mines where fire-damp may be present.

Decisions Relating to Mining.

Specially reported for the MINING AND SCIENTIFIC PRESS.

LOCATION OF MINE—'VEIN' OR 'LODE.'

The United States Statutes provide that mining claims or 'veins' or 'lodes' of quartz or other rock in place bearing gold or silver, previously located, shall be governed as to length along such vein or lode by the customs, regulations, and laws in force at the date of such location. The statutes further provide that where any person, in possession of a placer claim which includes a vein or lode known to exist within its boundaries, applies for a patent for the placer claim, but not including such vein or lode in his application, then the application shall be construed as a conclusive declaration that such placer claimant has no right of possession of the vein or lode; but when the existence of the vein or lode is not known, then a patent to the placer claim shall include and convey all valuable mineral or other deposit within its boundaries. A 'known vein or lode,' in the sense here used, is one clearly ascertained and of such extent as to render the land more valuable on that account and justify its exploitation and development. In the sense here used the term 'vein' and 'lode' are synonymous.

Noyes *v.* Clifford, (Mont.) 94 Pac. 842, March, '08.

OWNER OF SURFACE OF MINERAL LAND—RIGHT TO SUPPORT.

Where the surface soil of mineral lands is owned by one person, and the mineral underneath is owned by another, the owner of the surface has an absolute right to the necessary support for his land; and if the owner of the minerals in removing them removes the support for the surface, he is liable for all damages that result to the surface soil by reason of subsidence, regardless of how carefully or skilfully he may have conducted his mining operations.

Collins *v.* Gleason Coal Co., (Iowa) 115 Northwest. 497, March, '08.

LOCATION OF MINE—EJECTMENT.

In an action in ejectment the defendant claimed a lode-location within the boundaries of the plaintiff's placer-location; and the defendant without proof of location was held entitled to question the prima facie title of the plaintiff as shown by plaintiff's patent, by showing that the lode or vein in controversy was known to exist at the time the application for the patent was made, and that the defendant was justified in his apparent intrusion on the plaintiff's premises.

Noyes *v.* Clifford, (Mont.) 94 Pac. 842, March, '08.

MINING CORPORATION—LIABLE FOR PHYSICIAN SERVICES TO INJURED MINER.

A mining corporation was held liable to a physician for his services in treating an injured miner, where he was employed by the mine superintendent, who immediately reported the fact to the company, and its president and general manager ratified the employment and notified the physician to purchase necessary articles for the future treatment of the miner.

Cushman *v.* Cloverland Coal & Mining Co., (Ind. App.) 83 Northeast. 390, Jan., '08.

NEGLIGENCE—ASSUMPTION OF RISK.

A miner does not assume the risk of the mine-owner's negligence; and in the performance of his duties a shot-firer is not required to assume that the mine-owner has violated the statute or neglected its known obligations; and where he himself exercises the diligence required by the statute in certain work, and exercises the diligence, watchfulness, and caution which would be exercised by an ordinarily prudent man performing such dangerous service, he is not deprived of his statutory right of action for injuries, if he fails to discover the negligence of the mine-owner.

Kirby *v.* Manufacturers' Coal & Coke Co., (Mo. App.) 106 Southwest. 1069, Dec., '07.

ELECTRIC SMELTING OF IRON ORES.

An article read at the recent annual meeting of the Canadian Mining Institute, by A. Stansfield, of which the following is an abstract, presents an interesting review of the development and future possibilities of electrical power for smelting iron ores. The electric furnace has so far proved commercially successful only in the manufacture of crucible cast-steel, but recent developments indicate that it may successfully compete with the blast-furnace in the direct smelting of ore.

The most successful experiments along this line are those of Héroult and Keller in the production of pig-iron. Héroult's furnace consisted of a vertical shaft similar to a small blast-furnace, in which hung a central carbon electrode. The crucible was lined with carbon, which served as the other electrode, the current passing from the hanging electrode to the charge in the crucible of the furnace. The ore, with fluxes and sufficient carbon for its chemical requirements, was fed around the vertical electrode, the electric arc producing enough heat to set up the chemical reactions involved in reducing the ore to metal, and in fusing the resulting pig-iron and slag. The Keller furnace consisted of two vertical shafts in each of which hangs a carbon electrode, the current passing from one to the other through a connecting trough or passageway. The resulting pig-iron and slag collect in this trough. The Keller furnace has the advantage of being able to use a higher voltage than the Héroult.

Results from these small imperfect furnaces show a consumption of electrical energy of about 0.3 hp.-year and 800 to 900 lb. of coke per long ton of pig-iron. Hence, if electrical energy can be purchased at a cost per horsepower-year of less than that of two tons of coke, the electric furnace is the more economical, assuming of course, the general costs of operating the two to be the same. The electric furnace possesses other advantages, chief among which are: (1) the ability to use ore in a granular or pulverulent condition, since, in a blast-furnace, ores of this character are liable to be blown out with the furnace gases or obstruct the passage of the blast through the charge; (2) the possibility of treating titaniferous and other difficultly fusible ores, because of the higher temperature and greater consequent ease of fusing the charge; (3) the fact that in treating sulphurous ores, the higher temperature allows a larger proportion of lime to be used in the charge, permitting of larger elimination of sulphur as calcium sulphide; (4) the electric furnace does not require coke possessing the physical properties demanded in blast-furnace practice, it being used only as a chemical reagent.

Commercially, however, the electric furnace has many difficulties to overcome, one of the most important being the small scale on which, up to the present time, it has been constructed. In the Héroult furnace the height of the shaft is limited by the length of the electrode, though in an improved furnace designed by Haanel and Turnball a greater height of ore-column was obtained by a system of inclined shafts. Another weak point is the fact that no provision has been made for utilizing the heat of the waste gases, although Turnball has proposed the addition of a rotating cylinder through which the ore may be pre-heated in passing to the electric furnace.

Realizing the importance of reducing the consumption of fuel and of electric energy to the lowest possible point, Mr. Stansfield has calculated what he believes could be expected from a furnace in which the gases, arising from the reaction between charcoal and the ore, were used partly for the reduction and partly for the pre-heating of the ore. He concludes that, allowing for all losses, one quarter of a horsepower-year and 600 to 800 lb. of coke or charcoal would be required for the production of one long ton of pig-iron. No economical scheme for the direct reduction of steel from ore has ever been put in operation on a large scale. Both Stassano and Héroult have been successful in producing steel, but they abandoned the process as uneconomical. It is probable that the most satisfactory method of producing steel electrically will be to reduce the ore to pig-iron in one furnace, and convert the pig-iron into steel in another.

Electric smelting of tin ore has been experimented with by F. Matonet, and is described in a recent number of *Metallurgie*. The ore used contained 50% Sn, 7.6 Fe, 3.3 Zn, 1.9 Pb, 0.44 Cu, and 7 S. It was found necessary to roast the ore before putting it into the electric furnace. For the furnace treatment an approximately neutral or slightly basic and alkaline slag is best. A resistance furnace must be employed. The chief advantage of electric smelting is to be found in the fact that the slag will absorb much less tin as silicate and will occlude no metallic tin in the form of globules. The disadvantages of electric smelting are first the loss of tin as vapor and as dust, though this loss may perhaps be reduced when operating on a larger scale. The second disadvantage is the greater impurity of the tin produced. To remove lead from tin, a process similar to the Pattinson process may be employed. The tin product of the electric furnace contains about 2 or 3% of lead. The tin-lead alloy is heated to the melting point (about 230°C) and then slowly cooled to a temperature a few degrees above the melting point of the eutectics (180°C). This temperature is maintained for some time. The pure tin crystallizes out while the heavier eutectic mixture of 30% lead and 70% tin remains back. This may be repeated several times. By treating a 2% lead alloy in two refining processes, the lead is reduced to 0.2%. The eutectic mixture is then treated by mixing to produce an alloy containing 10% lead, which is commercially used for cooking utensils.

Marking tools with a name may be done by coating the surface with a layer of wax or hard tallow, applied when the tool is hot, cutting the desired lettering in the wax, being careful that each stroke shall penetrate to the steel, and then pouring dilute nitric acid upon the engraved wax, let it stand a short time and wash off with warm water; heat the tool until the wax melts, and wipe dry.

MINE REPORTS.

AMALGAMATED COPPER CO., NEW YORK.

The report of the Amalgamated Copper Co. is given below, without abridgment:

During the fiscal year of the Amalgamated Copper Co. which ended April 30, 1908, the fluctuation in the selling price of copper metal was greater than at any other period in the history of the copper trade. At the time of the last annual statement in May, 1907, there was an unlimited demand for the metal, the selling price at that time being in the neighborhood of 25c. per pound. This demand was afterward seriously affected by the severe financial depression throughout the country, and in the early summer of 1907 it suddenly slackened, and afterward almost altogether ceased. The price of copper meantime gradually declined; and during the last two months of the fiscal year the metal has sold at from 12 to 13c. per pound. The business paralysis in the United States, was, however, not fully reflected abroad, and most of the copper metal that was sold in the market (and this was a large quantity) was bought for European account, the purchasers taking advantage of the low price of the metal to replenish holdings, which had been allowed to become depleted during the former period of high prices. Immediately after the first falling off in the demand, there was a natural tendency on the part of the producers of copper to await better business conditions; and, during this period, as but little copper was sold, a large amount was naturally accumulated. After the price of copper had fallen considerably in the market, the officials of the various producing companies adopted the policy of curtailing the output from their respective mines at Butte. But after operating for a period of several months under curtailed conditions, during which time the producing cost was far in excess of the normal (owing to the fact that each company was producing only a small part of its normal output), it was deemed advisable to confine all operations to one unit. The mines and smelter of the Boston & Montana Co. at Great Falls were put in operation to their fullest extent, and with satisfactory results. In February, 1908, the surplus stock of copper had practically disappeared, and on March 1, 1908, the mines of the different companies and the Washoe smelter were again put into commission and are now being operated to their full capacity. The plans formulated by the engineers, mentioned in the last report, for the settlement of boundary rights and questions of apex have been in operation for over a year, and all parties having any interest in the matter have been satisfied with the results. The Tramway shaft, which has been sunk jointly by the Red Metal Mining Co. and the Butte & Boston Co., and through which it is expected that the ores from the Minnie Healey and the Snohomish and Tramway mines will be hoisted, has reached a depth of 1400 ft. below the surface, and is now being sunk to the 1500-ft. level. Cross-cuts from the lower levels of this shaft are now being driven into the contiguous territory, and the orebodies developed have been most satisfactory. The Washoe smelter, at Anaconda, has been equipped with electric power, thereby greatly lessening the cost of operation, and is able to treat 10,000 tons of ore per day without difficulty. The Boston & Montana Co. has throughout the year diligently prosecuted the improvements in its reduction works at Great Falls. All of the grading for the flues and dust-chambers has been finished, and the new stack, the top of which when completed will be 506 ft. above the foundation, has been built to a height of about 50 ft. The usual amount of development work in the different properties has been carried on throughout the year, and the results in most cases have been gratifying. The continued occurrence of high-grade ores in the lowest levels of the mines controlled by the Amalgamated Co., and in the adjacent mines of other companies, tends to confirm the confidence which the company's engineers have always had in the future of the Butte district. The saw-mills of the Big Blackfoot Milling Co. were operated to the extent required to meet the demand of the mines at Butte and the commercial trade generally. Some decrease in output was made necessary on account of the curtailment of ore-production at Butte and by reason of the fact that the demand for commercial lumber fell off materially during the financial depression. The said company has confined its operations to the timber areas adjacent to its original mill-sites. Its largest timber holdings still remain intact. The earnings for the year were quite satisfactory and the output of its mills is now normal.

The Belt mines, owned by the Anaconda Copper Mining Co., and the mines of the Diamond Coal & Coke Co. were operated with satisfactory results, notwithstanding the fact that during a portion of the year the demand for coal greatly diminished. Constant development work has been kept up throughout the year on the coal property, located at Bear Creek, Montana, and owned by the Washoe Copper Co., and the mines which have been opened have been for several months producing most satisfactorily. The quality of the coal is excellent and the field is one of great promise.

The harmonious operation of the five-year labor contract which was entered into between the employees of the different departments and the officials of the mining companies has worked satisfactorily. The companies owned wholly or in part by the Amalgamated Copper Co. produced in the calendar year 1907, from their own and custom ores, about 212,000,000 lb. refined copper, of which amount the Amalgamated Copper Co. received the benefit from about 178,000,000 pounds.

The company's balance-sheet shows net income for the year of $6,680,556, out of which dividends amounting to $6,155,516 were paid. The net income represents 4.31% upon the authorized capital of $155,000,000, nearly all of which has been issued. The investment on capital account stands on the company's books at $156,480,647, embracing all mines, plant, lands, and property of every sort, including securities.

BUTTE COALITION MINING CO., NEW YORK.

The report of the Butte Coalition Mining Co., the corporation which represents the brilliant achievement in financial diplomacy of having consolidated interests two years ago that terminated 80 pending lawsuits involving aggregate claims for damages amounting to $100,000,000, presents a report for 1907, showing an income from mine-earnings of $1,320,000 and from interest of $173,345. From the total is deducted $31,879 for salaries, office and general expenses, leaving a disposable balance of $1,461,465. The sum of $195,494 having been carried forward from the previous year, a total dividend of $1,650,000 was paid, leaving a balance $6959.

The mines worked continuously during the year up to the middle of September, when production was reduced 65%, and on December 1 production was entirely suspended. During this period of inactivity extensive development was performed in the Rarus mine, mainly on the lower levels, that is, the 15th, 16th, and 17th, the shaft having penetrated to a depth of 105 ft. below the 18th. The ore developed by this work is estimated to exceed the normal output of the mine for a year. During 1907 the stoping in the Rarus, stated in the terms adopted by the company, amounted to 2,053,055 cu. ft. of ore in place, figured from the square sets put in position, representing an advance of 9.72 miles 1 set wide and 1 set high (5 ft. by 8 ft.). Cross-cutting has shown that valuable and hitherto unknown ore-shoots exist outside of the main vein, and even in the principal veins themselves mineralization many feet beyond the walls into the enclosing granite has resulted in the formation of irregular bodies of copper-glance, many hundreds of tons of ore are being produced from such 'impregnations' alongside old abandoned stopes. One of these outlying ore-shoots has shown a volume of chalcocite which a year's stoping will not exhaust. Production in the Minnie Healey mine was interrupted in June by a fire in the old north-workings. The fire situation was taken in hand by the Boston & Montana Co., and the affected area is now well isolated. Development on the Minnie Healey has been done by cross-cuts from the Rarus, and from the Tramway shaft. The Corra main shaft was sunk to level 18, from which a

drainage cross-cut was extended through the Diamond mine to the Anaconda Copper Co.'s main pumping plant at High Ore, and arrangements have been made with the company to pump the Corra water. At the Tramway, development consists in part of sinking the 4-compartment shaft, 5 ft. by 18 ft. 10 in. in the clear, and timbered with 12 by 12 in. Oregon fir timbers. The shaft was deepened 326 ft. during the year, all compartments being sunk together. The Tramway shaft is now connected with the Rarus on levels 13 and 14, and will soon open into level 15. It also connects with the Minnie Healey orebodies on levels 10, 11, and 13, and communication will shortly be established with levels 14 and 15. This comprehensive system of development and inter-communication of workings will yield great economies in future operations, the design being that the Tramway plant shall serve the entire Rarus-Tramway-Minnie Healey group of mines. A 92-ft. steel head-frame has been erected, and elaborate equipment, including machine, boiler, and carpenter shops, tool-sharpening shop, and an elaborate change-house, with all modern sanitary arrangements, capable of accommodating 1500 miners, have been erected. The buildings are of structural iron and are entirely fire-proof.

During the period under review the mines of the company produced 377,240 tons of ore, yielding 51.47 lb. copper and 1.18 oz. silver per ton, the net yield of metals being 19,416,377 lb. fine copper, 444,809 oz. silver, and 2480 oz. gold. The report is barren of details revealing the technical and practical management of the company's operations. The cost of mining is not stated, and no data of any kind are furnished by which the capability of the management may be justified.

COMMERCIAL PARAGRAPH.

THE JEFFREY MFG. CO., Columbus, Ohio, has issued bulletin No. 24, describing their drop-rail mine-cage.

GEO. C. ROBBINS, formerly at Wallace, Idaho, has opened an assay office in the Union Trust Bdg., Los Angeles.

THE DENVER ENGINEERING WORKS announces that its Salt Lake office is now at room 316 Dooly Building.

THE H. W. JOHNS-MANVILLE CO. announce the opening of a branch office at 30 South Pennsylvania street, Indianapolis, Indiana.

THE MOORE FILTER CO., New York, has recently closed a contract with the San Rafael mine, Pachuca, Mexico, for a type A filter plant of 250 tons capacity.

WINSTON BROS., who are driving the Chicago, Milwaukee & St. Paul railroad tunnel through the Bitter Root range of the Rocky Mountains, are using twelve 3¾-in. Wood drills.

THE LANE SLOW SPEED CHILIAN MILL CO., Los Angeles, has issued the third edition of their catalogue describing the quartz-mill made by them, and include with it, a reprint of an article by C. C. Lane on 'Stamp and Chilian-Mill Experience of Forty Years.'

BOOKS RECEIVED.

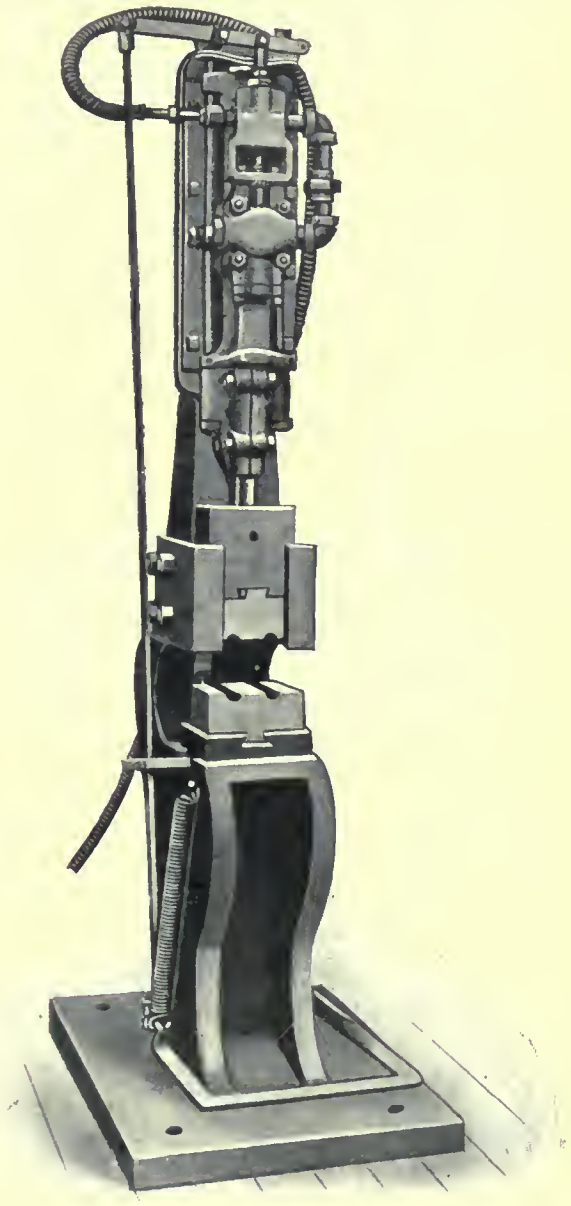
CONCRETE CONSTRUCTION. By Halbert P. Gillette and Charles S. Hill. 8vo., pp. 680. Ill. Index. Myron C. Clark Pub. Co., Chicago. 1908. Price $5. For sale by the MINING AND SCIENTIFIC PRESS.

The subject of concrete construction is presented by the author in such a way that it will appeal to contractors and, in a less degree, to designers and architects. It is one of those books which will furnish many useful hints and suggestions, but can not be considered as a complete guide. The authors give a valuable discussion of the constituent materials of concrete and the methods and cost of proportioning and mixing them. In the following pages many of the special uses and applications of concrete are described and illustrated, among them being concrete piles, bridge piers and abutments, retaining walls, pavement foundations, sidewalks, curbs and gutters, tunnel-linings, and the like. One chapter is devoted to laying concrete in freezing weather, one to reinforced concrete building construction, and another to methods of water-proofing concrete. Throughout the book much space is given to costs, and while the data are more complete than may generally be found in treatises on construction, such information must always be used with care, and is soon out of date.

CEMENT INDUSTRY IN THE UNITED STATES IN 1907. By Edwin C. Eckel. Advance chapter from the 'Mineral Resources of the United States for the year 1907.'

CONVENIENT SMALL STEAM HAMMER.

A light power-hammer is of great utility in a mine or smelter machine-shop. The accompanying illustration shows such a tool, weighing only about 2000 lb., but substantially built. It will work equally well with compressed air or steam, and consists of an adaptation of the D24 Ingersoll-Rand type of drill, with the special Ajax valve-control, giving perfect adjustment through a foot-treadle of the number and strength of the blows. The operator can control the valve from three sides of the hammer. This hammer is capable of forging material as large as 4 in. diam. It can be applied to all ordinary welding, shanking drill-steels, and even welding broken stems from stamp-mills. Yankee ingenuity has resulted in extemporized contrivances in many blacksmith shops, where old drills have been made to do such duty. But these are crude in the matter of control. It is exactly in the matter of such details that this mechanism meets the needs of the machinist. This hammer is made by T. H. Proske of Denver, Colorado.

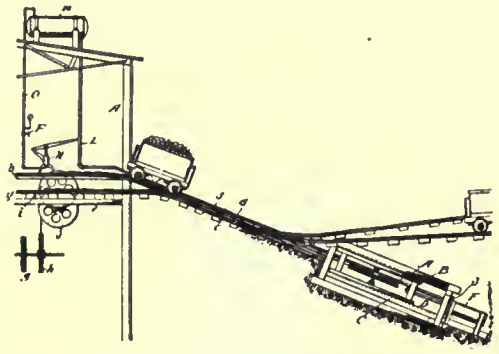


Light Power-Hammer.

MINING AND METALLURGICAL PATENTS.

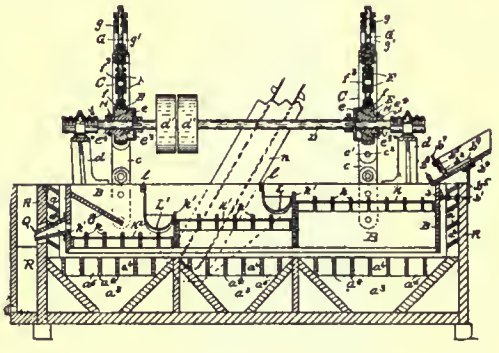
Specially Reported for the MINING AND SCIENTIFIC PRESS.

TENSION DEVICE FOR CABLE-CAR HAULS.—No. 888,439. Merrill Hibbard, Columbus, Ohio.



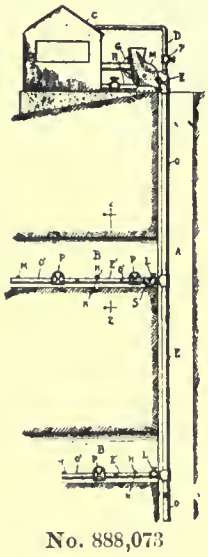
In a take-up mechanism for a cable haul, the combination with a bodily movable cable sheave or guide, and a movable holder therefor, of a cylinder, a piston therein connected with the movable holder, and means for supplying fluid pressure constantly in the cylinder against the piston, substantially as set forth.

ORE-CONCENTRATOR.—No. 887,922. George T. Cooley, Joplin, Missouri.



In an ore-concentrator, the combination of a tank; a frame movably mounted in the tank; a sieve in the frame; a series of partitions in the tank around the frame adapted to interfere with the movement of water in the tank; and means for imparting a combined vertical and horizontal movement to the frame, substantially as specified.

SYSTEM FOR VENTILATION OF MINES.—No. 888,073. William E. Elliott and John G. Wilson, Sharon, Pennsylvania.



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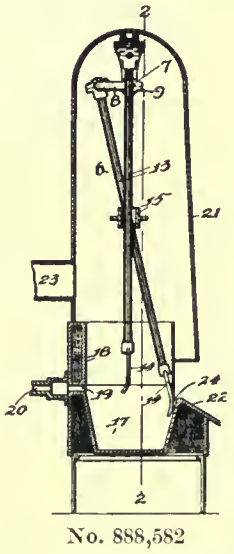


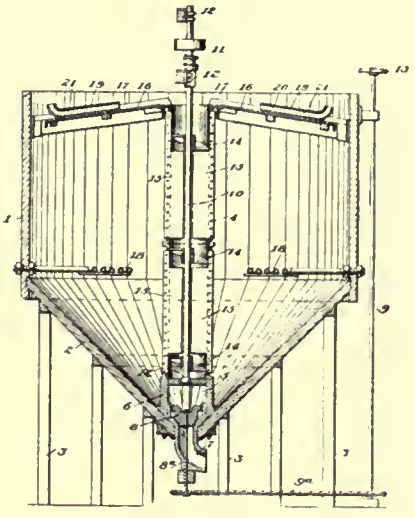
No. 888,582

In a system for the ventilation of mines, means for creating a current of air at substantially right angles to the direction of the length of a drive, said means including alternately spaced air inlets and outlets, substantially as shown and described.

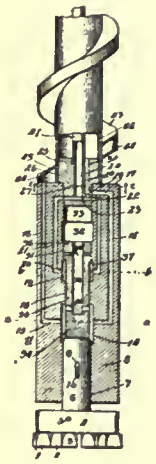
ROASTING AND SMELTING FURNACE.—No. 888,582. Josephus J. Brown, Jr., Troy, New York.

A device of the class described, comprising a plurality of agitators in combination with a roasting and smelting furnace, said agitators arranged to alternately dip into the hearth of the furnace to mix the material therein, and means for operating the agitators, substantially as specified.

APPARATUS FOR TREATING ORES.—No. 889,128. Wilbur A. Hendryx, Denver, Colorado.



No. 889,128



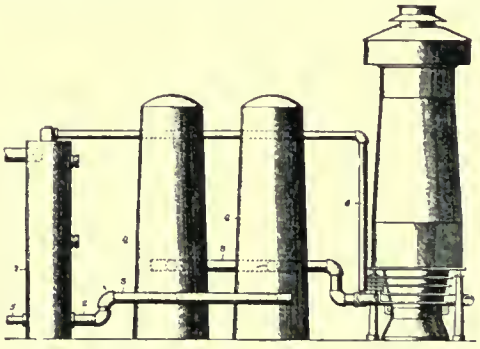
No. 888,164

Apparatus for treating ores, comprising a tank, means for continuously aerating the contents of said tank by lifting portions and moving them in a thin sheet or film in contact with the atmosphere, and electrodes disposed in the path of said lifted portions.

PNEUMATIC DRILL.—No. 888,164. Martin Hardsocg, Ottumwa, Iowa.

In a pneumatic drill, a hammer-frame consisting of a straight central barrel with oppositely running spiral flanges encircling the barrel and extending from end to end of the barrel, the barrel having a central chamber divided into sections, one section to receive a driven stem and another section to receive a driving hammer, and each spiral flange having a spiral induction passage and a spiral eduction passage, with the eduction passage of one flange terminating at the end of the flange and frame, and the eduction passage of the other spiral flange terminating in a port laterally extending inwardly, substantially as described.

ART OF SMELTING ORE.—No. 887,974. Alfred Steinbart, Pittsburg, Pennsylvania.



As an improvement in the art of smelting ore, the method herein described which consists in lessening the percentage of moisture in the air to be forced into the furnace to a point below that of saturation at atmospheric pressure and at the temperature of a natural cooling medium, maintaining the moisture at a slowly varying percentage below such point of saturation by subjecting the air to compression and to such natural cooling medium and forcing the air into the furnace.

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Editorial.

CONGRESS appropriated $1,335,520 for the maintenance of the Geological Survey during the fiscal year 1908-09. The bill specified particular sums, as usual, which should be applied to special purposes. For geologic survey-work the amount named was $200,000, for topographic surveys $300,000, and for fuel-testing investigations $250,000. The next largest items were $100,000 each for investigations of water resources and structural materials.

THAT MOST nomadic of men, Mr. J. H. Curle, contributes an interesting account of travels in many distant corners of the world, and as usual he hits out from the shoulder in making criticisms of men and things. Outspoken comment and fearless statement of fact are a tonic without which human affairs would grow musty; the fresh air of virile criticism drives off the mildews of self-complacency and corruption. And our friend Mr. Curle is ever frank and outspoken; his analyses of mining conditions in many parts of the world, made during his career as a writer to *The Economist*, to the MINING AND SCIENTIFIC PRESS, and to other journals, have proved correct in so many cases as to vindicate the accuracy of his judgment. We hope he will avoid malarial countries and be long spared to do useful work as a journalist, skillful and fearless.

IN THE DEATH of Quincy A. Shaw, the mining fraternity has lost one who graced it with intellectual and moral character of noble type. In an epoch in which the gaining of millions has seemed but to intensify the acquisitive spirit, and to weaken regard for the rights of others, Mr. Shaw for twenty years had quietly attended to the duties of a director in the Calumet & Hecla Mining Company, without seeking to play at Napoleonic finance, despite the temptations which have never been absent from the copper market. He chose to operate the mines which he virtually controlled for the sake of the available producer's profit, with no attempt at using the great power of his position to win an unearned increment through manipulation. Mr. Shaw was noted as a practical philanthropist, and had taken an advanced position in sociological matters indicative of a sincere desire for the general uplifting of humanity. He was 83 years old at the time of his death, on June 12.

THE REFERENCE in our London letter this week to the Briseis tin mine, in Tasmania, recalls the illuminated prospectus issued as an allurement for investors in England when the company was financed, in 1899. The promises of yield per cubic yard were based upon sampling done in the crudest manner, crediting the value per foot in

depth through the narrow section of the lower enrichment to the larger area of the upper lean gravel, without corresponding reductions. Such simplicity is difficult to understand, as is also the failure of the directors to make public announcement of the fact of error when that subsequently became known.

Yukon Gold Claims.

OUR Toronto correspondent recently stated that the Canadian Minister of the Interior, Mr. Oliver, replying to an interpellation by the leader of the opposition in Parliament concerning the Government's acquiescence in the manipulations of the Yukon Gold Company, divulged the fact that the title to the claims was conditional on the performance of work to the value of $200, and the payment of a renewal fee of $15, upon each claim every year. The question put by the opposition was of a sort that arouses unnecessary antagonism, since placer mining claims in the Yukon Territory are held under licenses issued by the Gold Commissioner that must be renewed annually. It would, however, have been as well for the Yukon Gold Company to have indicated the character of its tenure in an explicit manner in its printed statement. The report declared "the company has purchased sufficient creek claims and upper level or bench deposits, to control the mining situation." The conclusion of the investor would be that the company was in possession of its ground through title, unless he happened to be informed concerning the mining regulations for the Yukon Territory. There is indeed a mention of creek 'claims,' but common usage applies that name to a patented as well as to an unpatented claim, so that no particular pains were taken to hang out the red-lantern for the unwary. Some people, perhaps many, would prefer investment in a corporation holding its ground in fee-simple. The fact that title absolute has not or cannot be obtained under Canadian laws relating to the Yukon does not justify the conclusion that the investors have been seriously or at all affected. The title of the Yukon Gold Company is good so long as the laws are complied with. Many of the heaviest mining operations in the United States are initiated upon possessory titles, which may lapse if the laws are not complied with. It would appear that the opposition assumed the position of a carping critic for no better purpose than to awaken the public to a realization of some facts of Canadian law—which may be useful. It remains to add that the tenure of mining companies in Australia, even those involving millions of dollars, and operations that have continued for a score of years, is based on leases, usually for 15 years, renewable at the expiration of the term for which they are granted, provided that the rental is paid regularly and the mining regulations duly observed by the lessee. Such tenure under an irresponsible or corrupt government would be dangerous, but so in fact might be any title under like conditions. The Yukon Gold Company's holdings are perfectly safe and if the gold is there in sufficient quantity and can be extracted at a low cost, there need be no worry as to title. That is the least of their troubles.

Reform Movement in San Francisco.

PRESIDENT ROOSEVELT never more clearly demonstrated the sincerity of his devotion to the cause of civic betterment than in his letter to Rudolph Spreckels, which we re-print in this issue. Politics are not involved in this discussion. Mr. Roosevelt can have no left-hand purposes of personal aggrandizement in view. He is uttering the deep conviction of an honest private individual in whom there is hope, as a means of inspiriting those who have to fight the battle of civic respectability against such tremendous odds of villification and indifference as to give to the struggle at times an appearance of hopelessness. So Mr. Roosevelt sounds the clear and encouraging note of undaunted confidence. Faith is one of his leading characteristics, as it must be of all men endowed with perfect health of mind and body. It is at the root of his strenuosity, which has been misinterpreted as a motive, whereas his course of action is invariably strenuous because of the vigor and faith behind it. Conscious of the evils needing correction, the reformer must still be the cheerful optimist. Complaint and lament have no creative power. The man who has force within him to move others to good and useful acts takes the lead in jovial spirit, and calls for coöperation instead of sympathy. "My thanks are due to the American people, and not theirs to me, for the opportunity I have had to serve them," said Mr. Roosevelt recently, adding, "I have had a perfectly corking time." That breathes a spirit which makes men believe in a leader, and trust his capability of making a good fight. There is breezy health in that word 'corking'. It is not in the dictionary, but there is an unmistakable snap and fizz to it that conveys an impression which all men understand, and which makes them share his moral convictions. So has his counsel to Mr. Spreckels and to Mr. Heney come in a way that will help them in good-natured determination to re-establish civic rectitude in San Francisco. It would seem that this letter had been sent at a psychological moment, when the spirit of reform was in the air and needed exactly such a stimulus to render more effective the movement which has just been set on foot by a body of San Franciscans under the name of the Citizens' League of Justice. Headed by Matt. I. Sullivan, Barclay Henley, Rev. C. N. Lathrop, Walter Macarthur, John Sweeney, George H. Boke, and W. H. Payson, this association proposes to give determined support to the courts and officers of the law now engaged in the trial of persons accused of corrupting the public honor and violating the law of this State. It will continue its existence as a guardian of the honest administration of the city in the future, becoming a centre around which the stalwart moral forces of the community may gather, and find means to do effective service through competent organization. Unlike the determined Vigilantes who in times past applied heroic remedies to restore law and order, the League expresses faith in the efficiency of the constituted authorities to mete out justice, if sustained by the properly directed sentiment of the community.

BY THE WAY.

The White House, Washington, June 8, 1908.

My dear Mr. Spreckels:

Now and then you and Mr. Heney and the others who are associated with you must feel down-hearted when you see men guilty of atrocious crimes who for some cause or other suceeed in escaping punishment, and especially when you see men of wealth, of high business, and, in a sense, of high social standing, banded together against you.

My dear sir, I want you to feel that your experience is simply the experience of all of us who are engaged in this fight. There is no form of slander and wicked falsehood which will not as a matter of course be employed against all men engaged in such a struggle, and this not only on the part of men and papers representing the lowest type of demagogy, but, I am sorry to say, also on the part of men and papers representing the interests that call themselves pre-eminently conservative, pre-eminently cultured.

In such a struggle it is too often true that the feeling against those engaged in it becomes peculiarly bitter, not merely in the business houses of the great financiers who directly profit by the wrongdoing, but also in the clubs, in certain newspaper offices where business interests exercise an unhealthy control and, I regret to add, in other newspaper offices which like to be considered as in a marked degree the representatives of the cultivation and high social standing of the country.

Now, I do hope that you and your colleagues will treat all this bitterness with entire disregard. It is of small consequence to you, or to any of us who are engaged in this work, whether men think well or ill of us personally; but it is of very great consequence that we should do the work without flinching, on the one hand, and, on the other hand, without losing our good humored common sense, without becoming angered and irritated to a degree that will in any way cause us to lose our heads.

Therefore, I hope that you and Heney and your associates will keep reasonably good natured; but that above all things you will not lose heart. You must battle on valiantly, no matter what the biggest business men may say, no matter what the mob may say, no matter what may be said by that element which may be regarded as socially the highest element. You must steadfastly oppose those foolish or wicked men who would substitute class consciousness and loyalty to class interests, for loyalty to American citizenship as a whole, for loyalty to the immutable laws of righteousness, of just and fair dealing as between man and man.

It is just as bad to be ruled by a plutocracy as by a mob. It is profoundly un-American and, in a social sense, profoundly immoral, to stand for or against a given man, not because he is or is not a brave, upright, and able man, but because he does or does not belong to a labor union or does or does not represent the big business interests. In their essence, down at the foundation of things, the ties that are all-important are those that knit honest men, brave men, square dealing men, together, and it is a mighty poor substitute if we replace these ties by those that bind men together, whether they are good or bad, simply because they follow a particular business, have a given social standing, or belong to a particular organization. It is an evil and a dreadful thing for laboring men to endeavor to secure the political dominance of labor unions by conniving at crookedness or violence, by being 'loyal' to crooked labor leaders, for to be 'loyal' to the fancied interests of the unions when they are against the laws of morality and the interests of the whole people means ultimately the destruction of the unions themselves, as an incident to the destruction of all good citizenship.

But it is, if anything, an even more evil and dreadful thing to have the merchants, the business men, the captains of industry accessories to crime and shielders and supporters of criminals; it is an even more dreadful thing to see the power of men high in State politics, high in finance, high in the social life of the rich and fashionable, united to stifle the prosecution of offenders against civic integrity if these offenders happen to be their friends and associates; and most evil of all is it when we see crooks of a labor party in offensive and defensive alliance with the crooks of a corporation party. Labor unions and corporations alike should be heartily supported when they do good work, and fearlessly opposed when they stand for what is evil. The best kind of wage-worker, the best kind of laboring-man, must stand shoulder to shoulder with the best kind of professional man, with the best kind of business-man, in putting a stop to the undermining of civic decency, and this without any regard to whether it is a labor union or a corporation which is undermining it, without any regard to whether the offender is a rich man or a poor man.

Indeed, if there can be any degree in the contemptuous abhorrence with which right-thinking citizens should regard corruption, it must be felt in its most extreme form for the so-called 'best citizens,' the men high in business and social life, who, by backing up or by preventing the punishment of wealthy criminals, set the seal of their approval on crime and give honor to rich felons. The most powerful ally of lawlessness and mob violence is the man, whoever he may be, politician or business-man, judge or lawyer, capitalist or editor, who in any way or shape works so as to shield wealthy and powerful wrong-doers from the consequences of their misconduct.

You have heart-breaking difficulties with which to contend. You have to fight not only the banded powers of evil, but, alas, that it should be said, the supineness and indifference of many good men on whose zealous support you had a right to feel that you could rely. Do not be discouraged: do not flinch. You are in a fight for plain decency, for the plain democracy of the plain people, who believe in honesty and in fair dealing as between man and man. Do not become disheartened. Keep up the fight.

Very sincerely yours,

THEODORE ROOSEVELT.

Rudolph Spreckels, Esq.,
San Francisco, California.

Personal.

F. L. RANSOME is at Goldfield.

C. M. FUELLER has been in Nevada.

C. S. HERZIG is examining mines in Spain.

F. W. OLDFIELD is at Jamestown, California.

C. W. GOODALE leaves this week for Goldfield.

WALTER NEAL has returned to El Oro, Mexico.

MARK L. REQUA will arrive in San Francisco on June 29.

CHAS. G. YALE has returned from Jamestown, California.

F. N. FLETCHER has removed from Goldfield to Reno, Nevada.

J. H. CURLE is on his way home from Valparaiso, Chile, to London.

ARNOLD BECKER has gone to Nevada county, California, on professional business.

H. N. O. SPICER has returned from a professional trip in Mexico, to Denver, Colorado.

R. L. LLOYD, of the American Smelting & Refining Co., has left Salt Lake for New York.

R. T. WALKER is in Arizona, making investigations in various mines for the U. S. Geological Survey.

H. E. WEST, for the past two years engineer to the Spassky Copper Mine, Ltd., is returning to London.

ALBERT BURCH has returned to San Francisco from the McCracken Hill mines, Mohave county, Arizona.

JAMES DOUGLAS sailed from New York on June 17 for Europe. He will be absent about two months.

HENRY M. ADKINSON, formerly with the New England Co., of Bingham, Utah, is now at Telluride, Colorado.

R. B. WEDDLE has left Manhattan, Nevada, and will go at once to examine mines in Honduras and Nicaragua.

FRANCIS A. THOMSON has gone to Nevada, where he will be engaged in professional work for several months.

S. E. BRETHERTON, general manager for the Great Western Gold Co., Ingot, California, is at present in San Francisco.

F. S. SHEWELL has left Great Falls, Montana, and will erect a cyanide plant at the Phoenix mine, Cave Creek, Arizona.

WILLIAM KENT has resigned his position of Dean and Professor of Mechanical Engineering in the College of Applied Science of Syracuse University.

THOMAS T. READ, of the Imperial Pei-Yang University at Tientsin, has gone for an extended trip into the interior of China, which may take him to the border of Tibet.

F. LYNWOOD GARRISON will sail on June 27 for Colombia, accompanied by his assistant, WM. F. WARD. They will proceed from Colombia to Bolivia in October, returning to the United States in December.

ENGINEERING SOCIETIES.

The American Institute of Mining Engineers announces the 95th meeting to be held at Birmingham, Alabama, beginning September 29. Special excursions have been arranged to Chattanooga and Ducktown.

The Mining & Metallurgical Society of America has issued its Bulletin No. 1, bearing date of June 1, containing the list of officers and members of the society, the constitution, by-laws, and an announcement of the purposes of the organization as determined by the council. Fifteen districts have been set apart in the United States within which local sections will be established for mutual intercourse between the members. A general statement of intention to fix standards in engineering practice is set forth, and it is further announced that the society will discuss "questions relating to professional practice and ethics, with a view to the gradual formulation of rules for guidance, determined by the consensus of opinion in the Society." Bulletins will be issued monthly in future.

Latest Market Reports.

LOCAL METAL PRICES—June 25.

Antimony	12@16c	Quicksilver (flask)	$45@45.50
Casting Copper	14¼@15¼c	Spelter	6½@ 7¼c
Pig Lead	4.85@ 5.80c	Tin	31¾@33¼c

METAL PRICES.

By wire from New York.

Average daily prices in cents per pound.

Date	Electrolytic Copper	Lead	Spelter	Silver
June 19	12.75	4.50	4.53	54⅜
" 20	12.75	4.50	4.53	54¼
" 21	Sunday.	No market.		
" 22	12.75	4.50	4.53	54½
" 23	12.75	4.50	4.53	55⅛
" 24	12.75	4.50	4.53	54⅜
" 25	12.75	4.50	4.53	54¾

ANGLO-AMERICAN SHARES.

Cabled from London.

	June 18. £. s. d.	June 25. £. s. d.
Camp Bird	0 13 0	0 13 0
El Oro	1 5 0	1 5 7½
Esperanza	1 10 0	1 7 6
Dolores	1 5 0	1 5 0
Oroville Dredging	0 10 9	0 10 9
Stratton's Independence	0 1 3	0 1 3
Tomboy	1 13 9	1 13 9

(By courtesy of W. P. Bonbright & Co., 24 Broad St., New York.)

MINING STOCK QUOTATIONS—NEW YORK.

	Closing prices. June 18.	June 25.
Amalgamated Copper	68¼	65⅞
American Smelting & Refining Co.	77	75½
Boston Copper	11½	11⅛
Butte Coalition	22⅞	21¾
Cumberland Ely	7½	7½
Dolores	7¼	6½
El Rayo	2 3/16	2
Giroux	3¼	3¼
Greene-Cananea	11	10
Indiana Sonora	4½	4½
La Rose	7¼	5¼
Miami Copper	5 3/16	7
Nevada Consolidated	11⅝	11½
Newhouse	6⅛	5¾
Nipissing	7⅜	7⅛
Ohio Copper	2¼	1⅞
Tennessee Copper	36	36¼
Utah Copper	31½	32⅛
Yukon	3¾	3½

(By courtesy of Trippe & Co., 25 Broad St., New York.)

SOUTHERN NEVADA STOCKS.

San Francisco, June 25.

Atlanta	$ 16	Laguna	1.00
Belmont	82	Manhattan Con	9
Columbia Mtn	13	Midway	36
Combination Fraction	53	Montana Tonopah	1.45
Daisy	77	Nevada Hills	1.70
Fairview Eagle	55	Rawhide Queen	1.65
Florence	3.10	Sandstorm	25
Gold Bar (Bullfrog)	4	Silver Pick	14
Goldfield Con	5.30	St. Ives	25
Gold Kewanas	26	Tonopah Extension	83
Great Bend	26	Tonopah of Nevada	8.50
Jim Butler	23	Tramp Con	14
Jumbo Extension	29	West End	46

(By courtesy of W. C. Ralston, 353 Bush St.)

COPPER SHARES—BOSTON.

	Closing prices. June 25.		Closing prices. June 25.
Adventure	3¼	Mass	4¼
Ahmeek	71	Michigan	9½
Allouez	28	Mohawk	57½
Amalgamated	65⅞	Nevada Con	11½
Arcadian	3½	North Butte	65¾
Atlantic	15¼	Old Dominion	34
Bingham Con	60	Osceola	83
Boston Con	11½	Parrot	22
Butte Coalition	22	Quincy	84
Calumet & Arizona	107	Rhode Island	3⅜
Calumet & Hecla	660	Santa Fe	1¾
Centennial	23½	Shannon	13¼
Con. Mercur	43	Superior & Pittsburg	12
Copper Range	71	Tamarack	57
Daly-West	10⅜	Trinity	12½
Franklin	9½	Utah Copper	31½
Granby	96	Victoria	4½
Greene-Cananea, ctf	10	Winona	5½
Isle Royale	17½	Wolverine	130

General Mining News.

ARIZONA.

COCHISE COUNTY.

(Special Correspondence).—The preparations at the mines of the Copper Queen Co., for the new system of handling the ore, are rapidly nearing completion. The last haulage drift is connected; the heavy rails are down in nearly all of the important drifts, and the trolley wire is strung. The cutting of all but one of the ore-pockets at the Sacramento shaft is completed. On the surface, at the Sacramento, the hoist is complete, with the exception of the steam connections. Two back braces are being added to the steel head-frame. The circulating-pumps are installed, and the cooling tower is under construction. All the steel framework over the railroad tracks for the car-loading system is erected, and much of the work for the final installation of the conveyor-belts is complete. There has been very little change in the regular mine work during the last few weeks. The ore-production remains practically the same. There have been a number of new ore discoveries, but none of marked importance. The Uncle Sam shaft has reached a depth of 610 ft. and is still being sunk. The Lowell shaft is 1447 ft. deep, and a station is being cut on the 1400-ft. level. Shipping of low-grade sulphide to the Old Dominion smelter, at Globe, has been resumed.——The Calumet & Arizona-Superior & Pittsburg production is again over 1500 tons per day, of which about 875 tons is from the C. & A. mines and 625 from the S. & P. mines. The copper output at the smelter for the month of June will be more than 4,000,000 lb. ——The No. 8 cross-cut, on the 1300-ft. level of the Hoatson, an S. & P. mine, has been run 500 ft. south from the station, and there is still 600 ft. to go to reach the south end of the claim. The No. 12 cross-cut, on the same level, has passed through about 60 ft. of good sulphide ore.——On the 600-ft. level of the Shattuck & Arizona a good body of 7% oxide and carbonate ore has recently been struck. This new body is a good smelting ore, being high in iron. Nothing definite has been given out as to the erection of a smelting plant at Douglas, but it is believed that preliminary work will be commenced during the next three months.——A recent discovery of lead-silver ore near the centre of the Warren claim of the Wolverine & Arizona, is taken as an excellent indication of future copper developments. The Warren claim adjoins both the Shattuck and the Queen properties, and in another part of the claim a good body of copper ore has been developed during the last few months.

Bisbee, June 20.

The Grand Arizona Copper Co. has shipped a quantity of tools and supplies to its property, near Douglas, and expects to start development work at once.——A rich strike is reported by Adams & Strand in the Gunnison hills, five miles from Dragoon. The vein is about 8 in. wide and assays over $300 in gold, silver, and lead.

GRAHAM COUNTY.

Operations have been temporarily suspended at the Polaris property on account of some trouble with the business affairs of the Southwestern Development & Improvement Co.——The New England & Clifton Copper Co. has started its new compressor, and will soon have the hoist running. A campaign of extensive development is to be undertaken at the Antietam mine, and with the Copper King, above Clifton, shipping regularly, the affairs of the company seem to be in good shape.

MOHAVE COUNTY.

The Stewart Warner Co., of Goldfield, has purchased all the mines on Music Mtn., and is doing preliminary work of establishing a camp in that locality. The district is 22 miles north of Hackberry, and is connected with the railroad by a good wagon road.——The freight rate on ores from Chloride and Kingman to the smelter at El Paso has been materially reduced.——The C. O. D. Mining Co. has been re-organized and John Boyle, Jr., has been elected president. The new management will proceed with development along new lines.——Tracy & Carrow have disposed of their interests in mines near the old Fay property to Los Angeles men. Work is to be begun on the mines at once.

SANTA CRUZ COUNTY.

The American, 10 miles east of Patagonia, has started work, and three shifts are at work sinking the shaft deeper. The American has not been worked for 20 years. A new shaft is now down 90 ft. and will be sunk 60 ft. deeper.

YAVAPAI COUNTY.

(Special Correspondence.)—The Arizona Power Co. expects to start construction on its power-house within the next month. The plant is about 50 miles east of Prescott, on the Verde river. The water is brought through seven miles of conduits, from springs on Fossil creek and reaches the power-house under a head of 1050 ft. Doble impulse-wheels, and General Electric Co., 3-phase, 60-cycle generators will be used. The power will be transmitted at a pressure of 45,000 volts to Jerome, Prescott, and Crown King, and will be used by the mines and the nearby towns. The United Verde Copper Co., of Jerome, has contracted with the power company for about 40% of the output. Twenty miles of wagon road have recently been constructed from Mayer to the site of the power-house. The construction will be pushed, and R. S. Masson, who is in charge of the work, is authority for the statement that the wheels will be turning early next year.

Prescott, June 23.

CALIFORNIA.

CALAVERAS COUNTY.

A discovery of yellow ochre is reported from the Jumper mine, near Mokelumne Hill.——The Woods mill, at Melones, is now running a 100-ton mill-test on ore from the South Carolina mine. The new company has decided to erect a 10-stamp mill, the capacity of which will be doubled later.

MODOC COUNTY.

The Sunshine & Rainstorm group, in the Hogue district, has been sold to Bassler & Schane, of Georgetown, Colo. A cash payment of $4000 was made, and two shifts have already started work. A new hoist has been ordered.

NEVADA COUNTY.

(Special Correspondence).—It is reported that Louis Rosenfield of San Francisco will resume active operations at the Inkmarque mine.——A winze is being sunk from the 500-ft. level at the Idaho-Maryland, and the 700-ft. level put in condition for active operations. A drift will be run from the 700-ft. level to intersect the vein.——It is reported that financial arrangements have been completed for the early resumption of work on the Ironclad mine. It is planned to install an ample plant of machinery. E. S. Black is superintendent.——Local people are actively pushing work on the Lily property, situated near the Idaho-Maryland mine. Some good ore has been opened up.—Charles A. Marriner and associates have acquired a bond on the Grey Eagle mine and will immediately put 20 men at work on the property. At a recent meeting of the Zeibright M. Co. the old board of directors was re-elected. Developments are being pushed steadily at the property.——The new 5-stamp mill at the Hotwater claim, above Graniteville, has been practically completed. A small force is developing a good vein of quartz.——Dividend No. 2, of $5000, has been declared by the Delhi M. Co. A good surplus remains in the treasury.

Grass Valley, June 22.

SHASTA COUNTY.

The Brackett mine, which has been lying idle for the past month, has been re-bonded and extensive work begun. The mine was taken under bond by H. O. Cummins about a year ago, and re-bonded to a Minneapolis company, which commenced a long lower adit to strike the orebody about 200 ft. below E. W. Brackett's old workings. A gasoline engine and a blower have been installed, three shifts of miners put to work, and the lower adit is now going in at

the rate of over two feet per day.——Furnace No. 1 of the Monmouth smelter, at Kennett, has been entirely re-built and is now running. This is the first time in the history of the smelter that all five furnaces have been in operation at the same time.

SIERRA COUNTY.

The Forest City Mining Co., operating the Mabel Mertz mine, six miles east of Forest City, is pushing its main adit ahead with two shifts, and it is expected that the gravel channel will be struck within the next 30 days.——W. O. Frost has taken an option on some quartz claims at the old town of Kanaka City, owned by John F. Owens, of Forest. Mr. Frost has men at work clearing out the old adit on the claims, and intends to sink on the vein.——F. P. Roddy and associates, from San Francisco, have obtained a year's lease on the Grizzly Con., formerly known as the Poker Flat vein, between Poker Flat and Grizzly. They intend to make a 60-days practical test of the ore, and have sent men to commence work.——The Alaska mine, at Pike City, has recently installed two new transformers, a centrifugal pump, and new pipe-lines. Sinking on the new vertical shaft will soon be resumed and driving will not be started until it reaches a point below the old workings.

TUOLUMNE COUNTY.

A tunnel is being built in the Nonpareil, at Big Oak Flat, for the purpose of connecting for rock-breaker and the mill.——Operations have been resumed at the mine on the Major ranch.——It is reported that five additional stamps will be added to the mill at the El Oro mine.——The Riverside may add 10 stamps to its mill and install a cyanide plant.

COLORADO.

CLEAR CREEK COUNTY.

(Special Correspondence).—A 4-in. streak of 600-oz. silver-lead ore has been uncovered on the Wolverine mine, Democrat Mtn. Operations are being carried on through the upper Sunburst adit, at a point where the Astor and the Wolverine join. Driving is now under way and after opening the ground for 15 ft. the streak has been found to be continuous. From the ground in close proximity a heavy production was made a few years ago.——F. Winters has taken a lease on a vein cut through the Sidney adit, and has started stoping on a streak of 70-oz. silver ore, that is from 14 to 20 in. wide. Shipments are to be started next week.——Criley Bros., leasing on the Barmettler property on Ute creek, have struck a 10-in. streak of ore that assays from 1 to 1½ oz. gold and 22 oz. silver. The initial shipment was made this week consisting of about two tons. A solid streak of smelting ore 10 in. wide has been encountered in the west drift being run on the Gametta vein cut by the Joplin adit. The ore carries 65% lead, 2 oz. gold, and 97 oz. silver per ton. It was the intention of Manager B. J. O'Connell to start a raise as soon as the drift reached a point under the shaft workings, but so great did the improvement become that he decided that time would be saved by proving the extent of the discovery. Shipments are to be started at an early date.——F. A. Maxwell, lessee of the Colorado Central, has started a shipment of 1000 tons of lead-zinc ore to the Linn Consolidated mill. This ore will be treated for testing purposes, while the machinery is being adjusted. The Linn Co. tramway is not yet completed, and as the concentrator was ready to put into commission it was decided to treat this ore for Mr. Maxwell. In the event that the expected saving of the metals is effected, Mr. Maxwell will erect a similar plant. This ore is being taken from the Sleepy drift, run from the Equator adit.——A shipment of 18 tons of smelting ore was made last week from the Capital mines and a settlement of $5500 net was received, or at the rate of $305.50 per ton. This is the most remarkable body of ore ever uncovered in the history of mining in the Georgetown district. The streak of smelting ore is from 4 to 7 ft. wide in the west drift on the Aetna vein, while in the centre there is a break where about 4-in. rock appears. At no time during the history of mining in this district has such a large body of ore been uncovered at the same depth, operations being carried on 1700 ft. from surface. Alongside of the smelting ore is to be found from 7 to 10 ft. of concentrating ore.——It is evident that the Seven-Thirty vein has been lost in the raise to drain the shaft workings. This raise is now nearly 50 ft. above the bottom, and engineers state that it will be necessary to continue it to the level above, or else run cross-cuts to strike the vein. The men are at work 5600 ft. from daylight and great fear is manifest over their safety in case water should break through. However, 150 ft. of fuse is being used in shooting, giving the miners ample time to make their escape.——A big force of men is being employed by the Red Oak M. & M. Co., operating the Sunburst-Astor group of mines, Democrat Mtn. The old adits are being re-timbered and placed in condition to permit of the exploitation of a large area of virgin ground. On the Astor, which was never worked to a depth exceeding 240 ft. a shaft is to be sunk for another 100 ft. for the proving of the continuity of the ore-shoots. The upper adit on the Sunburst is to be extended several hundred feet also.——A syndicate of Denver men has secured an option on the Pulaski mine, situated on Leavenworth Mtn. The old workings are now undergoing an expert examination, while tests are to be made of the dump. The Pulaski vein was intersected by the Hall adit a number of years ago, a big body of medium grade ore having been uncovered. As the men financing that cross-cut did not own the vein no attempt was made to determine the extent of the discovery. However, now that the Hall bore is to be driven on into the hill, property intersected by it has come in great demand. The new company will operate from a tollage basis, as well as on its own account. B. J. O'Connell, of Georgetown, who has been appointed manager, states that a powerful compressor-plant will shortly be installed.——An energetic campaign of development has been started upon the Star group of claims in the Peru district. Arrangements have been perfected whereby operations are to be carried on through the Revenue adit. This company will also drive the Calla adit an extra 200 ft. to cut the vein 175 ft. under the deepest workings of the Revenue. John O'Dea has secured a lease on a block of ground and is running a drift on a streak of ore from 5 to 8 in. wide that mills as high as 3 oz. gold and 275 oz. silver per ton.——The Mendota mill, situated below the portal of the Victoria adit, is now treating exclusively dump matter carrying silver, lead, zinc, and iron. For the last three months Stephens Bros., the owners, have been netting $1200 per month, despite the low price of the metals. The mill now has a capacity of 60 tons per day, a number of improvements having been made.——A force of men has been sent to the Mineral Chief mine, Democrat Mtn., to place the workings in condition for the delivery of ore over the aerial tramway to the Linn Con. mill. This tramway will be in readiness to start within a couple of weeks.——H. Davenport has taken a lease on the sixth level of the Gold Dirt, Covode Mtn. Stoping has been started upon a streak of ore which is 18 in. wide, and assays $40 per ton in gold and copper. A. Thoman, leasing on the same level, is extracting a heavy tonnage of high-grade ore, one carload of $80 smelting ore being shipped each week.

Georgetown, June 22.

GILPIN COUNTY.

The Gilpin-Eldora Mining Co., owning the Eldora mine, near Central City, is planning to resume work within 30 days.——Two carloads of machinery for the Evergreen mill, in the Pine Creek district, were received at Black Hawk during the past week, which have since been hauled out to the new mill and will be installed at once.——The Black Hills & Denver Gold Mining Co. decided, at a recent stockholders' meeting, to resume work at its property in Boulder Park.

LAKE COUNTY.

Some improvements are being made on the Cleveland property, near Stumptown, which include the removal of a

portion of the old dump, so that it will not interfere with the working through the shaft. The men who were employed underground are now engaged in this work.——Rich ore is reported from the Hahnewald lease, on the No. 4 shaft of the Ibex, at a depth of about 1000 ft. The streak is not more than one inch wide, but it is claimed that it assays $125 per pound.

SAN JUAN COUNTY.

A fire at the Gold King mine, at Gladstone, destroyed all the buildings at the mouth of the adit, and did considerable damage to the tramway. Three miners, who were in the workings at the time, were overcome by gases accumulating in the workings, due to the closing of the doors of the adit. A rescue party was organized, and were successful in bringing out two of the men alive, but five of the party themselves were killed by the fumes.

TELLER COUNTY.

The newly constructed mill at Gillett started operations last week. The mill has been practically rebuilt by the lessees, who are to treat the old Kimball dumps, which average only $5 to $6 per ton in gold.——It is possible that the property of the Pinnacle Gold Mining Co., on the northern slope of Bull hill, may be worked in the future. An examination is being made by Cripple Creek men in the interest of a leasing company.

IDAHO.

SHOSHONE COUNTY.

(Special Correspondence.)—A feature of the mining industry all through the Coeur d'Alene this season is the immense quantity of machinery which has already been delivered or ordered for both the larger mines and the prospects. There is no way of gauging the amount that must have been spent in this direction since the beginning of the year, but railroad men state that there has been nothing like the past few months in the history of the country. This machinery consists for the most part of compressors and hoisting apparatus and even an occasional mill. Up to the present time the district has offered a splendid harvest for the different manufacturers and the prospects are that the demand will be increased rather than diminished throughout the summer. Enormous sums have already been expended in new equipment by the Hercules, the Hecla, and other big properties, and here and there arises talk of small stamp-mills for the outlying gold-quartz properties. Nearly 5 ft. of pure galena has been cut at a depth of 800 ft. in Bear Top mine, and further prospecting is increasing the value of the orebody, the full extent of which has not yet been determined. A slight fault was encountered, as in the upper workings, but after further driving of about 30 ft., 5 ft. of galena was opened up on the foot-wall. Since this the men have driven 12 ft. toward the hanging wall, which has not yet been encountered, while the adit shows high-class concentrating ore all the way.

Practically all the big mining companies of the district have now filed their annual statements with the county assessor, and according to these documents 1,366,076 tons of lead-silver ore have been shipped from the district during the year 1907, netting operators in Shoshone county a gross profit of $14,367,418, and a net profit of $4,810,522. While these figures are not quite up to the standard of 1906, owing to the depression in the metal markets, it is nevertheless gratifying to note that the number of shippers is steadily increasing, and even at lower prices there is but little doubt that the present year's production will exceed that of any year in the previous history of the county. The net profits of nearly all the big companies show a substantial decrease, for the reasons stated. The statement issued by the Federal Mining & Smelting Co. shows that the profits for 1907 fall short by over one million dollars from the record of 1906. In 1907 the four mines of this company extracted 800,200 tons of ore, of a gross value of $6,185,477, as compared with 933,577 tons extracted in 1906, of a gross value of $7,775,770, while the net profits for the two years respectively amounted to $1,588,707 and $2,685,212, and this in spite of the fact that the working expenses of the mines for 1906 were considerably higher than those for 1907. The accompanying table is a summary of the returns made to county assessors by the principal mines of the Coeur d'Alene for the year 1907.

Wallace, June 23.

(Special Correspondence.)—Some rich samples of pure galena ore from Bear Top mine, near Murray, have been on display at Wallace. The ore was encountered 800 ft. below out-croppings and is thought to prove the depth and permanence of Murray lead-silver veins. The rich ore was discovered along the foot-wall of the vein, and after driving 15 ft. still shows its original width of 4 ft. and shows no signs of diminishing. The vein is about 20 ft. wide at this point. The ore assays 30% lead and some copper.——A long cross-cut adit is to be run on the famous Copper King property, near Mullan, according to a decision of the owners at a recent stockholders' meeting. Work will begin in 30 days and continue till ore is opened on that level. The property is already well developed and was under bond to the Greenoughs when the copper flurry cut short the deal last fall. It contains large bodies of low-grade copper.——The Morning mill is now in operation with three shifts only one side, however, having been started. The other side will be started shortly, and shipments are expected to begin soon. Men are being constantly hired for the mine.

Wardner, June 20.

RETURNS FROM OPERATION OF THE COEUR D'ALENE MINES DURING 1907.

Name of Company.	Tons Extracted.	Gross Value.	Cost of Extraction.	Cost of Transportation, Reduction and Sale.	Value Improvements During 1907.	Net Profit.	Net Loss.
Morning	297,500	$1,497,325	$ 680,132	$ 512,482	$ 70,835	$ 233,876	.....
Standard & Mammoth	287,300	3,193,320	1,085,131	865,828	38,345	1,204,016	.....
Tiger	51,800	252,784	252,625	73,669	32,518	.....	$106,028
Last Chance	163,600	1,242,048	569,824	387,009	28,372	256,843	.....
Bunker Hill & Sullivan	312,800	4,180,210	666,803	1,463,200	183,724	1,866,483	.....
Hercules	20,466	1,615,684	178,038	329,093	343,392	765,161	.....
Hecla	117,430	1,244,685	440,282	333,349	33,864	437,190	.....
Frisco	55,846	493,664	229,564	230,332	61,300	.....	27,532
Gold Hunter	49,453	172,617	141,712	43,000	63,439	.....	75,534
Tamarack & Chesapeake	277	10,349	16,574	2,747	15,858	.....	24,830
Success	7,262	211,884	54,132	81,168	35,781	40,803	.....
Pittsburg Lead	2,342	252,851	72,966	73,796	21,440	84,649	.....
Snowstorm	95,435	1,396,258	216,393	569,684	155,892	454,289	.....
Stanley	122,979	.....	.....	.....	10,000	3,533	.....

MICHIGAN.

The Adventure has suspended all mining operations and are exploring with two diamond-drills. It is rumored that the stamp-mill will be sold.——The Cliff working shaft is nearly unwatered to the eighth level. Three drills are being operated, all of which are driving. The connection between the third-level drift and the old shaft, abandoned

30 years ago, should be completed by July. Twenty-five men are employed underground and the rock broken in development work is of a promising grade.——The Keweenaw Central passenger train ran into Calumet last week for the first time.——The completion of the cross-cut between No. 1 and 2 shafts of the Tamarack this week at a depth of 900 ft. will help solve the water problem at that mine. The cross-cut between the two shafts, at a depth of 550 ft., will be completed later this month. With both cross-cuts in use, Tamarack will be in excellent shape. No. 1 shaft is to be used only for hoisting water. At present Tamarack is handling a small amount of rock for the Ahmeek. Less than 30% of the Ahmeek tonnage goes to the Tamarack mill. It is only a question of a short time before the Tamarack will find it desirable to use even this tonnage at its mill for its own shipments. This will necessitate the Ahmeek shipping entirely to the Osceola mill, or, what is considered more likely, to the Isle Royale stamp-mill.——The Mohawk last week declared a dividend of $2.50 per share, payable July 10.

MONTANA.

French, Morse & Bassette have given a lease and bond on their mining property near Argenta to the Goldstone Mining Co. It is announced that the company is prepared to spend $50,000 in development work and installation of machinery. A large stamp-mill will be erected.——The Strawberry mine, near Pony, has just made its first shipment of concentrates to the East Helena smelter.——Stations have been cut at the 20th and 22nd levels of the North Butte, where everything is now in readiness for the starting of cross-cuts to the Edith May and Jessie veins. The Edith May vein at these depths is distant less than 100 ft. from the shaft, and should accordingly be intercepted in a month or two.——The new smelting contract of the North Butte with the Washoe smelters became effective June 1. By the terms of the contract, smelting costs are reduced about 50c. per ton, a very material saving on a daily output of more than 1200 tons.

NEVADA.

ESMERALDA COUNTY.

It is reported that the construction of a new 50-ton mill for the Rawhide Mining Co. will be started not later than July 1. The mill is to be built south of Rawhide, midway between the source of water and the Last Chance claim.——J. D. Hubbard and others have purchased the A. & M. group of 10 claims, seven miles from Hawthorne, on the Bodie road. A cash payment of $40,000 was made.——The Gem Florence lease, on the Florence ground, has secured an extension of six months, and an increase in the area of the holding. Work will be resumed and shipments again started. The lease is controlled by D. W. Smith and others, of Elmira, New York.——Satisfactory progress is reported at the Nevada Empress mill, at Gold Mountain. The machinery has been shipped and the building material is on the ground or at Cuprite. An aerial tram will probably be constructed.——It is reported that oil has been struck near Blair.——The mines of Goldfield produced, during the week ending June 19, a total of 2150 tons, valued at $178,940. The Tonopah mines produced 5895 tons, of an estimated value of $150,875.

HUMBOLDT COUNTY.

The Dun Glen mine, at Tiptop, is to ship its first car of ore soon.——The Tiptop Mine Owners' Association has adopted the Tonopah scale of wages, and the utmost harmony exists between owners and miners.

LANDER COUNTY.

The Dean mine, situated about 16 miles southeast of Battle Mountain, has resumed operations after a period of inactivity lasting since some time last year. A new 20-stamp mill is being considered, to take the place of the 10-stamp mill now in use.

LINCOLN COUNTY.

A rich strike is reported from the Duplex mine, at Searchlight. It is claimed the ore, which was uncovered on the 500-ft. level, will assay $15 per lb. in free gold.——The Esther group, three miles north of Searchlight, has been sold under lease and bond to the Central Trust Co. of Denver.——The Philadelphia shaft has reached a depth of 620 ft., and cross-cuts have been started both to the east and to the west.

NYE COUNTY.

Work has been resumed at the Quartette, on the south end of Ladd Mtn.——The machinery of the Homestake mill was run for the first time last Saturday, although continuous operation will not be started for a few days.——The Burner-Sweeny lease, at Telluride, claims to have uncovered some cinnabar ore at a depth of 35 ft.——Frank P. Davis and J. C. Humphrey have each taken a lease on a block of the Thelma ground, at Manhattan, and will start work at once.——J. B. Giffen, who was the first to use the dry-wash system at Manhattan, is installing a Westerfield machine on the Verde ground and a Curtis on the Golden Gate, on both of which properties he has leases. It is his intention to put two shifts at work on each machine at once, and as soon as everything is in running order, to work each to its full capacity. When three shifts are working, the two machines will handle 200 yards of dirt per day. The samples of the gravel assayed $1.40 per ton, and Mr. Giffen expects to save on an average of $1.25 per ton.——Arrangements have been completed for the erection of a 100-stamp mill at Walker lake to treat Rawhide ores. The treatment will be amalgamation, concentration, and cyanidation. The site will be about five miles below Schurz.——A discovery of great interest to the whole camp of Tonopah, and of undoubted value to the Belmont and other mines on the north of Mizpah hill, is the ore on the 1000-ft. level of the Belmont mine. Heretofore the veins encountered on the hill have been cut off on their easterly trend by the Mizpah fault and it was feared that no ore would be found north of this fault. The Belmont, however, has been doing extensive prospecting work on the main east cross-cut, and has gone through the fault and encountered a rich stringer of high-grade sulphide ore at least 50 ft. to the north of the fault.

WHITE PINE COUNTY.

The Ely Central has started an active campaign of development. A three-compartment shaft is to be sunk on the Weber claim, and two small shafts will be put down for prospecting purposes. Five men are now at work in the adit on the Intervention group.——H. A. Woodworth has purchased the Lucky Strike group of four claims, in the Hunter district. The consideration was $6500.

UTAH.

JUAB COUNTY.

The Gemini, better known as the Keystone, is installing two big electric pumps on the lower levels of the mine. This is taken to mean that deeper mining is planned by the company.——The lease given some time ago upon certain parts of the Bullock mine has expired, and it is the intention of the company to push development work on its own account. Two winzes will be sunk in the sulphide ore, one each in the north and south drifts. A raise will also be made on the orebody recently uncovered.——The Mammoth mine will be closed from July 1 to 10, in order that the machinery about the mine may be overhauled and repaired. It is expected that ore shipments will be resumed within the next 10 days, from the tonnage accumulated in the bins and on the dump.——Shipments of ore from the Tintic mines for the week ending June 20 were as follows: Bullion Beck, 3 carloads; Centennial Eureka, 39; Eureka Hill, 3; May Day, 5; Sioux Con., 1; Uncle Sam, 2; Tetro, 1; total, 54 carloads.

SALT LAKE COUNTY.

Jesse Knight, of Provo, has, with a number of friends, secured control of the old Emma mine at Alta, which in the '70s was sold to English capitalists for $5,000,000. The mine was a failure and caused an international scandal. Last year several Utah operators obtained the property from its English owners and began work, in the belief that its resources had not been exhausted. During the fall three

shipments of silver-lead ore were made, and a 2-ft. vein of the same ore is now being followed.

SUMMIT COUNTY.

Six men started work this week on the Giles Con. property, in Big Cottonwood district. It is reported that other mines in that neighborhood will also open soon.——The payroll of the Daly-West numbers 100 men at present, and will be increased as soon as the men can be used.

WASHINGTON.

FERRY COUNTY.

(Special Correspondence.)—The Copper Key reports a strike of copper sulphides, in a raise from the No. 2 adit. The company is now extending the No. 3 adit, in hopes of striking the same orebody. The Hercules, owned by J. T. O'Connell, of Republic, has struck galena and copper in its adit.——The drift running centrally through the first vein on the Grant Con. is reported to have struck higher-grade copper ore than it has been hitherto revealed. Work is to be continued steadily.——The first car of ore from the old Republic mine has been sent to the smelter. This mine, which was formerly active and treated a large amount of gold ore, has been idle for several years until a short time ago, when Richard Mulroy leased it and began operations.——J. L. Harper, manager of the Pearl Con. mine, at Republic, states that the property will be reopened again in a short time. Some Kentucky people who recently made an examination are expected to return this week and take hold of the mine. There is a large amount of development work done.

Republic, June 22.

OKANOGAN COUNTY.

(Special Correspondence).—The Ruby mine has been shut down during the absence of the manager, who has gone to eastern cities to secure funds for the establishment of a reduction plant. Seven carloads of ore were shipped to the Tacoma smelter during the spring, but owing to high freight this rate will not be continued.——A diamond-drill is now operating on the Kelsey properties, on Kruger Mtn.——The Nighthawk mine is installing a new concentrator which it is expected will be in operation in a few weeks.

Chesaw, June 15.

STEVENS COUNTY.

(Special Correspondence.)—The Eagle group of claims has been sold by the Eagle Con. Gold Mining Co. to the Blue Star Mining Co. for $13,000. Two other claims have also been purchased, which adjoin the United Copper. The adit will be extended from the Eagle to this vein, which is here 12 ft. wide. The lead-silver vein on the old Eagle group will be explored by a winze at the same time.——The United Copper is now shipping 40 tons of ore per day to the Northport smelter. Development work is in progress on the winze being sunk to the 900-ft. level.

Chewelah, June 13.

CANADA.

BRITISH COLUMBIA.

The shipments of ore from Granby mines, Phoenix, for the month of May were 93,316 tons, and with the exception of last March was the biggest monthly tonnage ever sent out from the mines. In March all the furnaces at the smelter were running at full capacity, while during May two furnaces were out of commission for a considerable length of time. The shipments for the first five months of 1908 total 294,317 tons, showing a big increase over the same months last year.——The Jumbo mine, at Rossland, has resumed operations.——The Oro Denoro mine of the B. C. Copper Co., in Summit camp, has been making a good showing in the shipping list since resuming a few weeks ago. Fifteen to 17 cars of ore are now being shipped daily to the company's smelter at Greenwood, and its shipments of 3270 tons last week are more than equal to its entire tonnage in 1907. Sixty men are now working in two shifts at the mine, and it is expected the tonnage will continue to increase.——The Big Bend mica mines, near Revelstoke, will begin operations soon. A crew of men has been sent in by way of Beaver.——It is reported from New York that the Britannia copper mines, on Howe sound, will be opened the latter part of this month.——The Phoenix M., S. & D. Co. has been organized to work the Woodburn mining property, in Wellington, three miles from Phoenix. The new company is receiving proposals for the driving of a 200-ft. adit, and other development will be started in the 600-ft. shaft now on the property. The ore is said to be rich in copper and gold.——The Bertha Mining Co., at Grand Forks, is to install a stamp-mill and gravity tram.

Following is the tonnage of ore shipped from and crushed at the mines of Rossland for the week ending June 13, and for the year to date:

Mines.	Week.	Year.
Centre Star	3,000	79,971
Le Roi	1,575	38,924
Le Roi No. 2	350	12,269
California-Giant	....	95
Blue Bird	....	110
Red Eagle	....	20
Evening Star	70	488
Total	4,995	131,887

There was received at the Consolidated Co.'s smelter, at Trail, during the past week, 4284 tons of ore. Besides that received from Rossland, shipments came from other mines as follows: Snowstorm, 603 tons; First Thought, 154; St. Eugene, 89; North Star, 23; Richmond Eureka, 45; Ymir, 22; Silver Cup, 31 tons.

ONTARIO.

Shipments from Cobalt for the week ending June 13, and since Jan. 1, in pounds, are as follows:

	Week June 13.	Since Jan. 1.
Buffalo	.....	653,710
Coniagas	63,100	568,680
Cobalt Lake	.....	246,455
Crown Reserve	.....	84,000
Cobalt Central	.....	56,380
City of Cobalt	.....	452,110
Drummond	.....	148,600
Foster	.....	238,400
Kerr Lake	57,980	462,300
King Edward	.....	127,240
La Rose	60,000	2,361,652
McKinley	123,600	1,497,160
Nipissing	.....	1,743,120
Nova Scotia	43,990	271,540
Nancy Helen	.....	140,420
O'Brien	276,330	2,817,300
Right of Way	61,050	303,290
Provincial	.....	143,210
Standard	.....	39,730
Silver Leaf	.....	196,620
Silver Cliff	.....	52,000
Silver Queen	.....	634,510
Townsite	.....	85,100
Tem. & Hudson Bay	65,000	664,000
Tretheway	67,600	1,065,050
Watts	.....	246,020
Little Nipissing	40,100	40,100
Totals	798,760	15,874,508

MEXICO.

The San Mateo Mining Co., Urnachi, Chih., has completed the 690-ft. adit to cut the vein, and rich silver-gold ore has been struck. The company is planning to put up a small water-jacket smelting furnace. T. A. Ripperdan is general manager.——A 20-stamp mill is to be erected on the Santa Catarina mine, at Santa Catarina, Oax.——A 75-ton stamp-mill is being built on La Mejia group of mines, near Saric, Son. It consists of six 150-lb. rapid-crushing stamps, with amalgamators and concentrators. This is an old property, developed to a depth of 240 ft., showing a width of vein of 85 ft., all of which is in silver-bearing quartz in porphyry.

Special Correspondence.

LONDON.

Botallack, Cornwall.—East Pool Developments.—Cornish Operations in Malay.—Tronoh Mine.—Briseis Tin, Tasmania.

One of the most interesting mines in Cornwall is the Botallack. In fact it is of romantic interest seeing that the shaft is on the cliff and the workings extend under the sea. After being closed down for many years it was re-opened by the Allen & Meyerstein group eighteen months or so ago. A great deal of money has been spent clearing and re-timbering the old levels and sinking a new main shaft. Also electrical machinery and producer-gas plant have been provided. Most of this work has been done by William Thomas. Recently he handed over the work to Captain W. R. Thomas, of Tywarnhaile, on his removal to Camborne to take up his duties as consulting engineer to the Allen & Meyerstein group. Forty head of stamps are being erected, twenty being already in position and ready to start. At first the material on the dump will be treated, but it will not be two months before ore is being brought up from the stopes. I hope before long to give a complete account of the mine and the new plant. Another event of considerable interest in connection with tin mining in Cornwall is the striking in the lower levels of an unusually strong vein at East Pool. This vein so far as at present developed is 6 ft. wide and contains 140 lb. of black tin per ton. The ore is remarkably clean and is free from wolfram and arsenic. In the upper levels of the mine the ore that is at present being worked is very complex, containing wolfram, arsenic, and copper. As the workings go lower the other metals disappear. It is found also that in depth the veins dip into the adjoining Agar mine, which belongs to the same company. The Agar property was acquired about twelve years ago, chiefly with the object of enabling the engineers to drain the lower levels of East Pool. As a mine, Agar has not been a success, and has to that extent been somewhat of a clog on the company, though indirectly from the drainage point of view the expenditure has been worth while. Now that the rich East Pool veins are dipping into it, Agar may yet come into prominence as a mine. It is of interest at this juncture to mention that the company at present in control has been working East Pool on the cost-book plan since 1834. There are 6400 shares on which £4 13s. 3d. has been paid up. The total distribution per share to date has been £74 16s. 6d. There is an inclination in some quarters to find fault with the cost-book system, because proper provision for reserve funds and funds for extension of plant is never made. East Pool is an example to the contrary, for very large sums have been spent out of revenue for the purpose of re-organizing plant and extending operations. The present discovery of such rich ore is most welcome. It must be remembered that the content is more than three times that of the ore now worked at Dolcoath.

A good deal of Cornish money is employed in operating tin mines in other parts of the world, especially in Malay and the East Indies. It may seem odd that the money should be used thus instead of in re-opening the old mines. The reason for all this is a long story. When the Malay production became so large 30 years ago the reaction in the market for tin hit the Cornishmen seriously. The Eastern deposits are mostly gravel and are worked by cheap labor. Against these conditions deep Cornish mines could not compete. To get some of their money back, Cornishmen took up Malay properties. I believe that at the present time more new Cornish capital goes to Malay than to the local mines. For some reason it is the fashion for James Wickett, the stockbroker of Redruth, to advise his clients to go into Eastern gravel mines, and the Cornish smelters, the Lanyons, Bains, Pearces, and Bolithos, follow him. One of the most interesting of the Malay companies is the Tronoh. The shares in this company are held about equally in England and in the East. It was formed in 1901 with a capital of £160,000. Dividends have been paid amounting in all to 150% so far. The output has averaged about 2000 tons of tin concentrate per year. During the last year or so the production has become rather less for one reason or another, chiefly because the method of underground mining adopted is not now suited to the condition of the deposit. It has been decided to make a change, and in future to work open-cast. For this purpose a good deal of new capital-expenditure will be required. It has been found impossible to issue new shares in the existing state of the money market, so the profits for the whole of this year are to be allocated for the purpose. Gilbert Pearce, head of the tin smelting works of Williams, Harvey & Co. and brother of Dr. Richard Pearce, is the chairman of the Tronoh company.

It is appropriate to mention the Briseis tin mine in Tasmania, about 30 miles northeast of Scottsdale. This company was floated in 1899 by the Venture Corporation. At the time there was considerable criticism with regard to the high price paid in relation to the nature of the deposit. In 1903 the company's engineers, Lake & Currie, found the

limits of the deposit, and since then no further discovery has been made. At the present rate of working the deposit will be exhausted in about a year. The company also owns a 58% interest in the adjoining New Brothers' Home property and also owns the Ringarooma property. The first named is a good producer, but the latter has not yet been proved. During 1907, the amount of gravel treated at Briseis was 449,400 cu. yd., and the yield 1017 tons of concentrate. At the New Brothers' Home 215,200 cu. yd. yielded 396 tons, of which 52% went to the Briseis company. The total metallic output of the Briseis and its proportion from the New Brothers' Home was 910 tons, which sold for £151,222. These figures compare with 912 tons and £168,123 during 1906. The profit for 1907 was £109,219, and £90,000 was distributed as dividend. It was not until 1906 that dividends were paid, and in that year £112,500 was distributed. With only another year or so of life before it there is not much chance of the capital being returned. The issued capital is £600,000, of which £190,000 in cash and £320,000 in fully paid shares went to the vendors, the Venture Corporation. Events have justified previous criticism relative to over-capitalization in this instance.

It was known as early as 1900 that the original valuation of the gravel had been grossly over-estimated, but profits could have been made had not unnecessary equipment, not warranted by the extent of workable ground, been installed. We speak of the costly water-way constructed to bring water to the mine.

ROSSLAND, BRITISH COLUMBIA.

Lead Bounties, Past and Present Effects.—Granby Dividend.—Ore Discoveries in the Josie.

The most important piece of news received in this district during the past couple of weeks, is the information that the bounty on lead mined in Canada, which was to cease on June 30, is to be continued for another period of five years. The sum set aside for the payment of this bounty five years ago was $2,500,000, of which only $700,000 has been used. This was a strong factor in favor of the extension of the term. This grant is for a bounty of $15 per ton on lead mined and smelted in Canada when the price of that commodity is ruling at £12 10s. on the London market, or when the selling price is under that figure. When the price of lead rises above £12 10s. then the bounty begins to decrease until, if the price of the heavy metal should rise high enough, the bounty would entirely cease. This condition actually existed when lead was at its highest figure a year or so ago. One of the features embodied in the new term of the grant is that instead of the bounty beginning to decrease when the price of lead reaches £12 10s. it will begin to be reduced when the figure is £14 10s. This is a point that the lead miners have placed great stress upon, because owing to the condition of the lead mining industry in the Slocan at the present time, having to contend with a recalcitrant lead-zinc ore and other difficulties, including lack of adequate transportation facilities, the miners feel that they must have a stable minimum price behind them in order that they may operate their mines and develop this portion of the mining industry of British Columbia without losing money. There is no doubt whatever but this bounty during the last few years has been a stimulus to lead mining in the Slocan. Many small prospects, with showings of high-grade ore, that are now shipping and in a fair way to become large mines, would be still closed down but for the bounty. The big mines have found it of great assistance, especially when the price of lead was low and the cost of mining high. Another point in the new arrangement is that the amount of bounty to be paid during any one year will not be limited to $500,000, as heretofore. This will tend to stimulate production should the mines produce a big tonnage in any year while the bounty is in existence. The beneficial effect can be realized when it is stated that for the year 1904, 12 months after the grant had been made, the lead produced in British Columbia amounted to 36,646,244 lb., valued at $1,421,874, while for the year 1907, which was even lighter than 1906, the lead produced was 47,738,703 lb., valued at $2,291,458, an increase of 11,092,459 lb. An industry of this magnitude is worth fostering, especially when it may be said to be still in its infancy. The total amount of lead produced in British Columbia alone, from the time when the Hudson's Bay Co.'s trappers dug it up for bullets, to the end of 1907, is estimated to be worth about $19,917,197.

Great advances have been made in Canada during the last few years in the manufacturing of lead pipe and other forms of useful articles. As the demand is growing throughout the country and as there is a tendency toward stronger tariff protection there will no doubt be a time in the near future when the lead mines of the country will be paying the Government a bigger bounty than the lead-miners are receiving today.

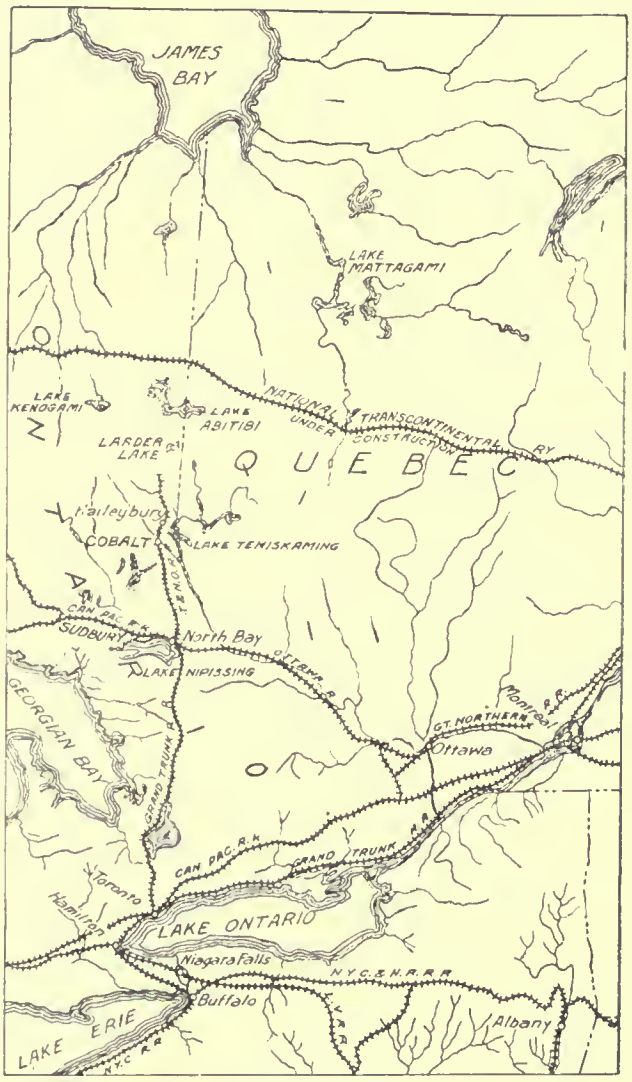
The report that the Granby Co. had declared a dividend of 2% on the par value of its issued stock came as a mild surprise to mining men interested in this district. There has been much discussion as to whether it was paying the Boundary mines to operate under existing conditions and the declaration of this dividend settles the knockers.

Excellent ore is now being taken from the lower levels of the mines in Rosland camp. Last month from a lode that averaged 2 ft. wide, in the Josie mine of the Le Roi No. 2, Ltd., assays were obtained of 3.77 oz. gold and 6.7% copper, or $88 ore. Another vein that averaged 4 ft. 1 in., carried 2.82 oz. gold and 9.7% copper, equal to $79 per ton. While these bodies of ore, which are high-grade for this camp, have been running small in the Josie, yet the rich gold-bearing ore found in the lower levels of the Le Roi and Centre Star-War Eagle mines has been uncovered in larger bodies.

TORONTO, CANADA.

Florence Mining Co. v. Cobalt Lake Mining Co.—Little Nipissing Begins Shipment.—Chambers-Ferland Sold.—Ore Shipments.—Crystal Mine, Wahnapitae.—Moose Mtn. Iron Mines.

The long-standing action of the Florence Mining Co. against the Cobalt Lake Mining Co. to set aside the patent granted to the latter company by the Ontario Government for $1,085,000, and to establish the claim of the plaintiffs



Map Showing Position of Cobalt and New Districts in Ontario.

on the ground of original discovery, was tried in Toronto before Judge Riddell last week. The facts of the case have been previously given, but the more important points may be briefly recapitulated. W. J. Green, who afterward assigned his claim to the Florence company, made a valuable discovery in 1906. He applied to have his claim recorded, but this was refused on the ground that the property was not open to prospectors, as an order had been issued in August, 1905, withdrawing Cobalt Lake. It was claimed on behalf of the Florence company that this order had been rescinded, as shortly afterward another order was issued withdrawing Coleman township, which was followed by a final order again throwing open Coleman township. As Cobalt Lake is situated within the township, it was contended that under this last order, it was also open, and maps issued about this time to prospectors showing the territory available for discovery confirmed

this view. However, the Government refused to recognize the claim, sold the property to the Cobalt Lake Co., and when the Florence Co. took the case to the courts, procured the passage of a special act validating the title of the holders. The legal proceedings were stayed until it was seen whether the Dominion Government would exercise its powers of disallowance and set aside the act. This it refused to do, and as a consequence, the action of the Florence Co. has been dismissed solely on the ground that the Legislature has absolutely unrestricted powers in the matter. On this point Judge Riddell was emphatic, while clearly indicating his opinion as to the confiscatory character of the legislation. In his decision rendered on June 15 dismissing the action with costs, he said: "The Legislature, within its jurisdiction, can do everything that is not naturally impossible, and is restrained by no rule, human or divine. If it be that the plaintiffs acquired any rights, which I am far from finding, the Legislature had the power to take them away. The prohibition 'thou shalt not steal' has no legal force upon the sovereign body, and there would be no necessity for compensation to be given." The counsel for the Florence Co. has intimated that an appeal will be taken and the case carried, if necessary, to the Imperial Privy Council. They are hardly likely to get a reversal of the decision, as Judge Riddell's interpretation of the law is in line with Blackstone's famous dictum: "The Parliament of England can do anything except make a man a woman, or a woman a man."

Heavy shipments of ore are being made from the Cobalt camp, the list of shipping mines being increased last week by the addition of the Little Nipissing, which sent a car of ore to Copper Cliff, taken from the property recently leased from the Peterson Lake Co. The shaft is down 50 ft. and the vein 5 in. wide is proving very rich. The Chambers-Ferland property in the heart of the ore-producing district, adjoining the La Rose, O'Brien, and Nipissing, has been secured by Montreal and Toronto interests and a company is being organized to operate it under the name of the Chambers-Ferland Mining Co., Ltd., capitalized at $2,500,000, the stock of which will shortly be put on the market. Two shafts are being put down, in both of which high-grade ore is encountered. The ownership of the property was for a long time in dispute, but finally a clear title was secured from the Government by an agreement to pay a royalty of 25% on the output. The Amalgamated property lying west of the Tretheway has been leased by Manager Madden, of the Little Nipissing.

The Crystal gold mine, at Wahnapitae in the Sudbury district, has been sold by Patrick Shannon, of Pembroke, Ontario, to a Toronto syndicate, including John T. Ryan, Stafford Higgins, and Gordon C. Jennings, Mr. Shannon retaining an interest. The mine was worked three years by a syndicate and considerable development work done, one shaft being sunk by hand-drilling to 185 ft. Transportation difficulties and the expense of introducing machinery caused the temporary abandonment of the enterprise, Mr. Shannon finally buying out his partners. A company has been organized with a capital of $500,000 and operations are being resumed with a modern plant, including a 10-drill compressor and a 10-stamp mill.

Everything is being put in readiness for extensive shipment of iron ore from the Moose Mountain mines, north of Sudbury, from Key harbor on the Georgian bay to the lower lake ports. The mines were visited recently by a party of American financial magnates interested in the iron and steel industry, including John W. Gates and J. F. Harris, of New York; P. W. Ogilvy and Leonard Miller, of Chicago; John Lambert of the American Steel & Wire Co.; C. B. McCullough, of the Lackawanna Iron & Steel Co., and Joseph Sellwood, of Duluth. The interests represented were mainly those of steel companies independent of the U. S. Steel Corporation, and it is expected that Moose Mtn. may become an important source of supply to American blast-furnaces. The project to establish a blast-furnace and allied industries on a large scale at Toronto, which was in contemplation before the period of financial stringency set in, is not likely to be resumed under present conditions.

JOHANNESBURG, TRANSVAAL.

Resignation of C. J. Price. — White Labor Problem. — Stope-Drill Contest.

Universial regret is felt in mining circles at the resignation of C. J. Price, the general manager of Eckstein's Central Administration. Mr. Price came to this country from the Black Hills, South Dakota, about twelve years ago, and has established a record of which any mining man may be proud. His first important post was that of manager of the Geldenhuis Deep. On that mine the success of the deep-level mines of the Rand very largely depended, for it was the first one to start. When Mr. Price went to this mine it was losing money. When he left it, a few years later, the mine was making about £20,000 profit per month. After serving on the Crown Deep, Mr. Price was given the important position of general manager of the Central Administration, and much of the splendid showing in the reduction of working costs at this group is due to his energy and capacity. It is with extreme regret that his many friends on the Rand learn of Mr. Price's return to America. He is one of the 'old guard,' one of the engineers that have helped in the making of the Rand, and it is always regretful for a mining community to lose such men. Mr. Price's place will be taken by W. W. Mien of California.

Quite an agitation is in progress over the white labor question. A few weeks ago, the majority report of the Government Commission was handed in, and now the leading spirit of that commission, F. H. P. Creswell, is stumping the Rand and urging the people to insist on legislation along the lines recommended in the report. From a purely political point of view, there is great weight in what Creswell and his friends preach. They show that the tendency is for the total wages paid to white men to decrease, while the money given to Kaffirs in wages keeps climbing up. The Transvaal shows no signs of expanding, and unless the white youths now growing up in our midst can be absorbed by the mining industry, there is little chance of their finding employment. The cause of white labor in the Transvaal is one for which Mr. Cresswell has suffered much. While few engineers agree with him in these conclusions, no one can help admiring the persistency and courage he shows in this single-handed contest. The wealth and intelligence of the Rand are against him, but he keeps pegging away, and his arguments are beginning to sink into the hearts of the white workers, especially of those few who expect to live in the Transvaal all their lives, and bring up families here. The wisest policy for the mines to follow now is to take on white men wherever possible, even if they are a bit more expensive for the present than Kaffirs. They must show a desire to solve the problem of the unemployed white or the Government is liable to pass laws compelling them to do more for the white inhabitants of the Transvaal. The departure of the Chinese has not helped the unemployed white one bit. There are ample Kaffirs for all requirements. The partial failure of the Gordon drill has been a great disappointment to those who hoped to find a solution of the unemployed-white problem in the use of this machine in stopes. The latest reports from the mines experimenting with the Gordon drill are far from encouraging. This machine made a great stir, and won the prize in the competition, but like a good many other things in mining, it takes time to develop it to high efficiency in practice. But the search for a suitable one-man stope-drill has not ceased. The Government and the Chamber of Mines are offering large prizes for a suitable drill. A stringent contest will start next year, and as ample time is given, it is thought that makers from all parts of the world will take part. Fame and fortune awaits the man who can successfully solve the stoping problem of the Rand, by the use of a one-man machine in the narrow stopes, whereby a white man will be able to break rock as economically and as satisfactorily as the Kaffir now does by hand labor. The first prize of £4000 will be awarded to that entry for which the total cost divided by total footage drilled by all machines of that entry during the competition is least.

GUANAJUATO, MEXICO.

Effect of Mining Law Revision.—Floods and the Drainage Tunnel.—Mexican Central Branch to the City.—Mine Developments and Output.—Magistral Smelter, Zacatecas.

The effect of the anti-foreign articles in the proposed new mining law is already being felt in several parts of the Republic, for it is known that a number of representatives of foreign capital have been wired by their principals to hold negotiations in abeyance pending action upon said articles; and it is believed that several large deals that were about to be closed will fall through, or at least be long delayed, in consequence. Many influential Mexicans are working against the articles in question, and even the Minister of Fomento, Olegario Molina, originator of the measure, has found the opposition so great as to wish to shift the responsibility from himself and his

Guanajuato After the Flood, 1905.

department and have the bill presented to Congress, so that the elected representatives may be held liable for the results. As that body has adjourned, the new measure will have to be passed upon by the President, or held until the next session of Congress in September. The latter expedient will mean that improvements and developments by foreign corporations will be held in check until then. The probabilities, therefore, are that the President will take action, and the belief is that the articles will be so altered as to simply require foreign companies to register in accordance with the Mexican law, and to have a legal representative resident in the Republic.

Another deluge visited Guanajuato on June 4 and threatened great devastation. While it lasted the fall of water was about twice as heavy as during the flood of 1905, though of much shorter duration. The great Porfirio Diaz tunnel, which was driven for drainage purposes, has demonstrated its usefulness. It is claimed that this alone saved the city from great loss of life and property. Considerable damage was done, particularly to the property of the Guanajuato Light & Power Co. At the conclusion of the tunnel-connections the covering over of the river through Guanajuato will be continued, as it is but an open sewer and an eyesore to the place. Though the Guanajuato Reduction & Mines Co. is treating 500 tons per day in its cyanide plant with great success, and the percentage of extraction has been materially increased since the installation of the Butters filter, it is doubtful whether the additions contemplated will be made during the continued low price of silver. Through train service in and out of Guanajuato was quietly inaugurated by the Mexican Central railway, on June 10, and this old camp is no longer at the mercy of the mule-car. The Mineral Belt railroad hopes to have its road completed by January 1, 1909, and new machinery will be ready to go in at that time. Development work is not waiting upon that, however. The San Cayetano, so long idle, is being opened up and developed; the Ruby tunnel, driven by E. J. Kimball, is in ore and shipping; the San Diego, on the Refugio vein, is showing ore rich in ruby silver; the Tres Coronas is in ore, and the owners are preparing to put in a small mill; the Guanajuato Amalgamated Gold Mines Co. is sending excellent ore from its Jesus Maria mine to its 100-stamps and a cyanide plant; the long tunnel of the El Roble (of Corwin & Greene) has cut the vein at a depth of 1000 ft., where good ore has been found; Pinguico keeps up its record for phenomenal richness; and the Humboldt, adjoining the Pinguico, is sinking a 1000-ft. shaft.

The Magistral smelter at Zacatecas will have a capacity of 300 tons per diem. The company has no intention of entering into competition as a custom smelter, and no statement to that effect was ever officially given out. Our previous reference to this was based upon a current rumor, which was generally accepted as a fact. The deal for the Bote has been called off by the present owners. The Mala Noche, which is owned by the Guggenheims, is not being unwatered.

BISBEE, ARIZONA.

New System of Ventilating.—Comparison of Fan and Compressed-Air Injector Efficiencies.

In the Copper Queen mines, the small ½-hp. electrically-driven ventilating blowers have recently been replaced by a new type of compressed-air blower, which is proving satisfactory. The principle upon which this new blower works is the same as that of an injector. A jet of compressed air passes first through a small nozzle, and then through three succeeding nozzles, each larger than the preceding one. This compressed air draws in free air around the sides of the nozzles and the whole is discharged through an air-pipe into the face of a drift or the top of a raise. The compressed air is delivered to the blower through a ½-in. pipe. The first nozzle, which is made of brass with a steel casing inside to prevent injury, has an opening $^{1}/_{16}$ in. diam. The comparison, as worked out with a fair degree of accuracy in the Queen, between the electric blower and the compressed-air blower, is as follows: Discharging through 300 ft. of 6-in. pipe at the elevation of Bisbee (5300 ft.), a 330-watt electric blower delivers 300 cu. ft. of air per minute. This is known as a ½-hp. blower. The 5-in. compressed-air blower with 95 lb. air-pressure, and a $^{1}/_{16}$-in. nozzle takes 19 cu. ft. of free air per minute, and delivers under the same conditions 380 cu. ft. of air per minute. The cost of steam to compress the air for the air-blower is about four times as great as to generate the power for the electric blower, or running them both continuously, the cost of power for the air-blower is about $6 per month more than for the electric. To offset this increased expense for power, about $6 per month is required for inspection, oils, and repairs on the electric blower, while these items amount to almost nothing on the new blower. The initial cost of the electric is more than three times as great as that of the air-blower. As a rule, the compressed-air pipes are in the drifts, carrying air for the machine drills, while often electric wiring has to be done especially for the electric blower. This would be more often true in the future, as the amount of under-

ground electric lighting is being decreased. Often a small station has to be cut for the electric blower, while the other type can be put up wherever there is room for a 6-in. air-pipe. Another advantage is that increasing the length of the air-pipe, the amount of air delivered by the air-blower does not decrease as rapidly as with the electric, on account of less friction in the blower itself. This new blower is equipped so that it can be used for exhausting the bad air from the drifts instead of blowing in fresh air, and the efficiency ought to be nearly as great. For anything larger than a ½-hp. blower, the cost of compressing the air is prohibitive; the large electric blowers being only slightly more expensive to maintain than the smaller ones.

BUTTE, MONTANA.

North Butte Co.—Butte Coalition.—Damages by Floods.—United Copper Co.—North Butte Extension.

The North Butte Mining Co. will open the Edith May vein on the 2000 and 2200-ft. levels in about three months. The stations and skip-pockets at those levels will be completed in about 40 days, when cross-cutting will be started. The North Butte is mining on the 800, 1000, 1200, 1600, and 1800-ft. levels and is hoisting about 45,000 tons of ore per month, half of the ore being first class, which averages about 8% copper; the rest is second class and the average of all the ore shipped is running form 5½ to 6% copper. The North Butte has an amount of ore blocked out sufficient to last the company for years. The cross-cuts on the 1600, 1200, and 1000-ft. levels will be extended to the Berlin group of claims. Serious litigation is threatened against the La France Copper Co. by the municipality of Walkerville. The company is operating a dry process metal separator at the Lexington mine and is creating so much dust that the little city north of Butte is suffocating. An analysis of the dust in the drinking water discloses 2% copper, 19% zinc, 9% iron, 45% sulphur, and 4% silica. The council of Walkerville has directed its attorney to institute an injunction suit against the La France Company.

The Butte Coalition Co. is developing in the Tramway and Minnie Healey mines. Until that is completed actual mining will be confined to the Rarus, from which about 850 tons of ore are shipped daily. Between 10 and 15% of it is first-class ore, averaging better than 10% copper. The entire output of the mine averages 5½%. A large 'chippy' engine—20 by 72 in.—is used at the Tramway for sinking and development work, but a magnificent hoisting engine has also been installed, though it will not be used much until operations on a large scale are started. The engine is a duplicate of that at the North Butte mines—32 by 72 in.—and capable of working to a depth of 3500 ft. It is expected to add about 30,000 tons per month to the output when the Tramway begins producing. The Tramway claim itself is practically undeveloped.

The annual report of the Butte Coalition Mining Co., including a statement of details by A. C. Carson, the general manager, as to operations during the year ending December 31, 1907, contains some facts that were new even to Butte. Mr. Carson reports that the Anaconda Co., working through the Diamond shaft, has exposed some fine orebodies within the boundaries of the Parnell claim, at a depth of 1200 and 1500 ft., and that development work is now being done to determine if the orebodies belong to the Parnell or to some adjoining claims, owned by the Anaconda Co. The Butte Coalition Co. owns a fourth interest in the Parnell, and if it should develop that the Parnell is entitled to the veins, the Coalition Co. would gain considerable addition to its reserves. The financial report shows that the cash on hand at the end of the year was $3,503,156 against $4,169,082 the previous year. Most of the decrease is accounted for by development work, but it is understood that the company also paid a large sum to the Anaconda Co. as rebates on copper.

Floods and consequent damage to railroads and smelters during the past two weeks in Montana greatly impeded mining, and the June production of copper will be reduced fully one-third, as compared with the production in May. The mines of the Boston & Montana Co., which produced nearly 3500 tons of ore per day, have been closed for two weeks, and some will probably remain closed for a month or six weeks longer on account of washouts on the Great Northern railroad between Butte and Great Falls and because of damage by floods to the smelter itself. A portion of the power-house of the smelter at Great Falls was wrecked by the flood and the water from the head-race ran through the power-house aud over the machinery. The lower works of the smelting plant were flooded, and the north wall of the head-race was broken out by the flood. A portion of the wall of the head-race was dynamited to divert the flood, but by the time that had been accomplished most of the damage had been done. The Butte, Anaconda & Pacific railroad, between Butte and the Washoe smelter at Anaconda, was badly damaged by washouts and by wrecked bridges, resulting in a suspension of traffic for four or five days, and a consequent closing of all the mines that shipped to Anaconda, including those of the Anaconda, North Butte, Butte Coalition, Butte & Boston, Washoe, Trenton, and Parrot companies. The Clark mines and smelter were also shut down for several days on account of water that overflowed the smelting plant, and the storm that put the electric car line out of business in Butte, stopping ore transportation from the Original mines.

The 'report' made to stockholders of the United Copper Co. at the recent New York meeting caused little surprise or comment in Butte, where little is looked for and less expected from the company. The public has always been kept in the dark as to United Copper holdings and income, but in Butte it has been known that many of the so-called assets of the company were of no value and were practically fictitious, as they included the former Heinze companies now owned by the Butte Coalition Co. The treasurer's report shows that for the fiscal year ending June 1, 1908, the income was $861,023 as compared with $6,565,592 the year before. The surplus 'available for dividends', was $800,482 as against $6,475,007 for the previous year. The Heinze directors were elected, the board being composed of F. A. Heinze, John MacGinnis, Stanley Gifford, Chester Glass, H. G. Abel, Sanford Robinson, William J. Curtis, A. B. Cook, and Carlos Warfield. Mr. Heinze declined to furnish the stockholders with any detailed information, saying such statements were not usual. He said the debts of the company, or its subsidiary companies, were not pressing, and the $1,100,000 would pay off the floating debts. The Ohio Copper Co., one of the subsidiaries, has an indebtedness of $500,000, and the Stewart Mining Co. about $60,000. The company has no producing mines, but Mr. Heinze says the Ohio, Stewart, and La France could be made producing, but there is no use to do so at present prices of copper. The United Copper Co.'s receipts come from securities, but the company owns few dividend paying stocks at present.

The North Butte Extension Copper Mining Co. seems to have become involved financially very late in the history of the panic. During the past week several attachments have been put on the property, one for $5000, due on a note given by the company to L. A. Walker and John A. Ryan. Stockholders in the East appear to have had advance notice of impending trouble, for the stock was thrown on the market in large blocks, the sales in one day on the New York curb amounting to 35,300 shares, forcing the price down from $2.50 to 40c. per share. It is surmised that a lot of stock owned by promoters or insiders was released and thrown on the market. The company has not paid current wages and operations have been suspended.

The new Tramway shaft of the Butte Coalition and Butte & Boston Co. is now down 1400 ft., and from it the Minnie Healey orebodies are being opened at that depth. It is probable that it will be a long time before the upper levels of the Minnie Healey can be worked again, because of the gas from the fire that is smouldering in the old stopes and eating into the old orebodies. The fire is well confined, but the gas breaks out most unexpectedly.

Concentrates.

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

Cold chisels for use on cast steel should have their entting edges meet at an angle of 65°, for use on brass an angle of 50° is better, and for copper and soft metals use 30 to 35 degrees.

Compressive strength of timber is materially reduced by the presence of moisture, be it sap or water absorbed after seasoning. Seasoned wood, having less than 12% moisture, is from 75 to 100% stronger than green timber.

The Dos Estrellas Mining Co., operating at El Oro, Mexico, has a capital of only ₱300,000, in ₱1 shares. The company has paid to date the splendid sum of ₱6,510,000, the last dividend being 50cv. per share, in April of this year. The present market price of the shares is ₱95.90.

A man can pass over 12.5 times the space horizontally that he can vertically, with the same expenditure of effort. A 165-lb. man can, by walking in alternate directions upon a platform supported on a fulcrum at its centre, produce work of 3,984,000 foot-pounds per 10-hr. day.

Files clogged with copper or brass should be cleaned with nitric acid. For iron filings use first blue vitriol, and after washing it all off with water, dip the file in nitric acid. Be sure to wash all the acid off, and rinse in water containing caustic soda. Then thoroughly dry the files.

The modern steam engine utilizes as effective work 12.7 to 15.7% of the units of heat introduced as fuel under the boiler, while the gas engine shows an efficiency of 19 to 23.2% of the heat units in the fuel used. This mere thermal superiority of the gas engine does not prove, however, that it has the greater commercial economy in all cases.

Astronomical time, or local mean solar time, is the time that would be kept by the mean sun, and is obtained from Standard, or railroad time, by adding or subtracting 4 minutes for each degree of longitude that the place of observation is east or west of the Standard meridian. The astronomical day begins at noon of the civil day of the same date, and is reckoned from 0 to 24 hours.

Tight shot is a term used by coal miners for a charge which is too deeply laid, or as they say, 'too much on the solid.' The result is that instead of doing the desired work, the gases escape through a blow-out, at a high temperature, and are more likely to produce explosions of coal dust or fire-damp than when the shot expends its heat in doing the work intended in blasting.

Rupture-load for a 'cap' or other mine-timber may be calculated by the formula $W = 2\ \frac{1.28\,bd^2}{L}$ where b, d, and L represent breadth, depth, and length between supports, in inches, S the mean tensile and crushing strengths of material at $^2/_3$ its experimentally determined value, and W the ultimate strength. The formula assumes the cap or beam to be uniformly loaded throughout its length.

Chrome iron-ore has long been used as a lining for reverberatory furnaces in copper smelting. It resists corrosion better than any other substance yet discovered. It is useful for the bottoms, bridges, and sides of the furnace, and for the partitions and floors of the flues, especially when the ores contain some lead. The chromite should be used in the form of large blocks, fitted together as accurately as possible, the interspaces chinked with smaller pieces, and the joints filled with a mixture of crushed chromite and zinc-blende, which is very refractory. Such a lining will last many times as long as the best fire-bricks. For the firebox-lining bauxite bricks are superior to any other kind.

Crushing-rolls may be kept true by placing a block of emery so that it will rest by gravity upon the rolls while they are in motion. This hint was given in 'Concentrates' about a year ago. A correspondent writes that he has applied this suggestion with great success. He says, "I got some carborundum blocks and fitted them onto the frame of a set of 30 by 16 in. rolls so that they pressed by their own weight on the back of each roll. The frame for the blocks was made and fitted by the blacksmith. The carborundum blocks were 8 by 3 by 3 in., and cost delivered (in Queensland) $2 each. They lasted 2½ months, and kept the rolls perfectly true, without taking off much metal. The blocks can be renewed in a few minutes. The saving in time from not having to turn up worn roll-shells, has resulted in an important saving in money. This simple arrangement ought to be more widely known."

Pitot's tube is a device for measuring velocities of streams by means of the velocity-heads which they produce. In its simplest form it consists of a tube open at both ends, bent in the shape of the letter L. When held in a moving body of water, so that one leg is horizontal, with its open end directly facing the current, the velocity is measured by the vertical height to which the water rises in the other leg. This height, h, is theoretically equal to $v^2/2g$. Therefore the velocity, v, is approximately equal to $\sqrt{2gh}$. As constructed for actual use, Pitot's apparatus consists of two tubes, one of which faces up-stream and the other at right angles to it. Both of these tubes are connected to a different gauge, by means of which the difference of head may be measured. It has been found by experiment that the actual velocity is always less than $\sqrt{2gh}$, and that a coefficient may be deduced for each instrument by moving the apparatus in still water at known rates of speed. Such a coefficient will probably have an average value of about 0.9. The pitot tube has the advantage that no time-observation is required to determine velocity, and it has been proved to be an instrument of considerable precision, especially in the measurement of high velocities.

Discussion.

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy.

Waters, Meteoric and Magmatic.

To the Readers:

Gentlemen:—The article under the above title contributed by Mr. James F. Kemp in our issue of May 23 will have proved both interesting and suggestive to mining geologists. The Professor of Geology in Columbia University makes even meteoric waters sparkle with a touch of humor and into those emanating from the magma he injects some of his own cheerful spirit, so that a subject which could not well be dry is made as attractive as viticulture.

As to the magmatic waters, I leave them to the physicist; they are much beyond my ken; there is nothing I can contribute to the elucidation of what is essentially a deep subject, but in regard to meteoric waters, their distribution and character, I can venture—as once a mining engineer—to make some observations. Mr. Kemp refers to the theory of a water-zone suggested by me in the discussion on ore deposits that took place before the Geological Society of Washington in January 1903. Two years earlier he had himself contributed a paper on a kindred subject to the *Transactions* of the American Institute of Mining Engineers (Vol. XXXI, p. 187), and in that paper he had incidentally referred to the absence of free water in the deeper workings of mines, stating that it was such as to disprove "the conception of universal ground-water." But I went much further and cited evidence to indicate the existence of a water-zone, the top of which was the 'water-level' of the miner, while the bottom of it was usually only a few hundred feet deep, as indicated by a horizon beneath which mines become dry if care be taken to prevent the water following in the wake of excavating operations, that is, if the water is 'caught up' and pumped to the surface. This idea was discussed by me in a paper entitled 'Water in Veins—A Theory,' published in *The Engineering & Mining Journal* of March 14, 1903. It elicited some valuable discussion by W. H. Weed, G. Chalmers, J. E. Spurr, W. A. Prichard, Bernard MacDonald, and others. And then the subject was dropped. The idea did not seem to commend itself to geologists as of any particular importance, although to me, with all the egotism of a father, this child of my imagination seemed fitted to be of service in mining geology.

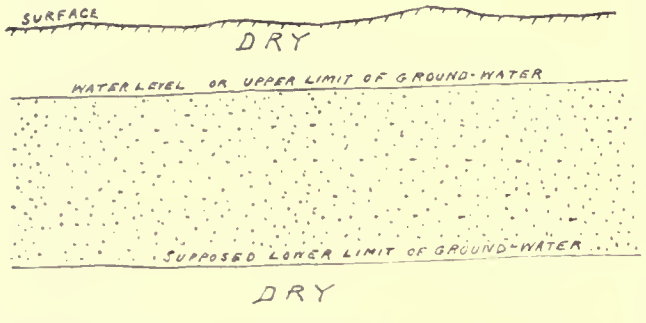
It does seem as if our understanding of ore deposition cannot be placed on a sound basis until we have obtained a clear notion of the distribution of the ground-water, that is, water of meteoric origin which accumulates a short distance below the surface and into which our mine workings penetrate. Most of the metalliferous ore extracted from mines comes from the comparatively shallow zone within which the ground-water is so important a factor, both to the miner and to the geologist. Acknowledged authorities such as C. R. Van Hise speak[1] of "the belt of saturation" below the top level of the ground-water as being "limited to a depth of 10,000 metres," and the idea has long prevailed among most writers on ore deposits that while there is a well-defined upper limit to this ground-water (as Posepny emphasized by his introduction of the term 'vadose'), the lower limit is vague, ending at the region of rock-flowage, at all events, at a horizon so far below the deepest possible mine workings as to be a matter of surmise. The ore deposits known to man have been formed well within the 10,000 metres or 33,000 ft. of the supposititious water-saturated belt of the earth and yet geologists have assumed the formation of fissures and other openings through which mineral solutions have coursed so as to precipitate their burden of metallic elements. This is the conception running all through the text-books on geology and the essays on ore deposition. We might as well imagine a mountain stream entering a morass, passing through the morass, and issuing at the other end without loss of its individuality; moreover, the accepted conception of vein-formation within "the belt of saturation" supposes the stream to enter the morass without losing its identity, flowing through it to the farther end, with slight exchange of ingredients, and with its distinctive character unimpaired. Indeed, the water-zone has many points of similarity to a morass, for it is a region wherein both reducing and oxidizing conditions variously exist, owing to the presence of organic matter on the one hand and of entrained oxygen on the other. In the water-zone the conditions favor oxidation near its top level, and reduction near its base; while approach to the surface means nearness to the oxygen of the air, it also entails contact with organic compounds.

Observations in mines go to show that there is a shallow layer of water beneath which the rocks become rapidly less moist, and while I am aware that even the 'dry' rock of mines contains from 3 to 5% water, able to move by capillary attraction, yet there is a sudden change below the water-zone from a continuous body of water, filling every pore and every cavity, to a condition so different as necessarily to become a decisive factor in ore deposition. For instance, in the Rocky Mountain region it is the usual experience, when sinking a shaft, to strike water at a couple of hundred feet below the surface, then the inflow of water increases until the shaft has been sunk to six or seven hundred feet, where the maximum inflow is encountered and the largest pump-equipment is installed. On resumption of sinking, if the water overhead is caught and pumped to the surface, the influx of further water decreases, and at a thousand feet or thereabouts the ground is 'dry,' that is, there is no free water visible, although on analysis it will be found that the dusty rock contains at least 3% moisture. However, there is a marked tendency for moisture to diminish and for free water to cease. To the miner the fact of maximum water at a certain level is known: it is a fact indicating that he has penetrated below a reservoir or accumulated store of water. In mining operations, the shaft is apt to continue to be wet long

[1] 'Genesis of Ore Deposits.' Page 291.

after it has been sunk below the level of maximum inflow because the lateral openings on the vein, with the connecting stopes and raises, afford a chance for the water from the upper portion of the mine to seep downward. At the risk of destructive criticism I shall express these ideas by means of diagrams; thus in Fig. 1 there is illustrated the first recognition of a water-zone; in Fig. 2 a shaft is sunk and the workings from below the under limit of the water-zone tap the water overhead so that a V-shaped depression is formed in the bottom of the water-zone. But this is what happens when fault-fissures and other openings exist; moreover, the rock under the water-zone is of varying texture, it is fractured in many directions, it is traversed by systems of fissures, and into these the ground-water descends to a varying extent, so that the net result is to make the lower limit of the water-zone not a plane (or a line in cross-section), but an acutely serrated and most irregular boundary, as in Fig. 3. Thus a shaft may be sunk away from a vein and yet on connecting it with a cross-cut, the water from the vein makes the shaft wet; or, again, the mine workings may have penetrated below the water-zone at one place and yet intersect it at another place, where, for instance, a fault or a cross-course

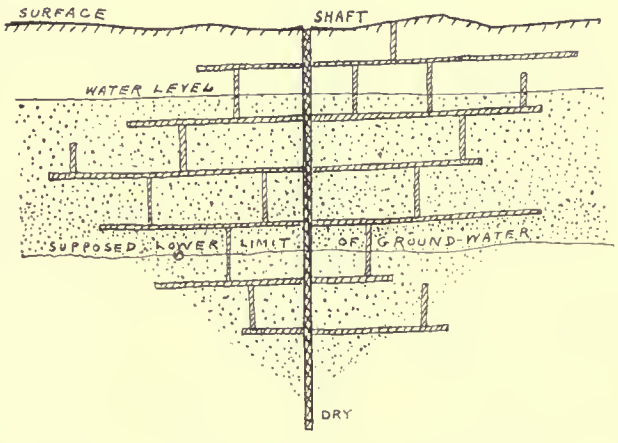
FIG. 1



has afforded a chance for the water to descend, that is, to let down the water-zone.

There is no warrant for the assumption of a water-saturated belt of indefinite thickness. If it existed, mines would become wetter the deeper they were excavated. The ability to drain whole mining districts proves that the water forms a shallow reservoir. Thus at Cripple Creek the first adits drained the upper workings of all the mines within a connected area. As the deeper cross-cuts and drifts tapped an increasing portion of the water-zone, the inflow increased and the deepest shafts were the wettest. Even when the shafts were sunk below the level of maximum inflow, the communication (through stopes and raises) with the upper workings tended to maintain a big influx and the cross-cuts that were extended in every direction in the search for ore tapped water-ways the contents of which also found their way to the deepest shafts, which thus became a 'sump' or well for the whole district. The Portland, Moose, Elkton, Mary McKinney, Moon Anchor, and C. O. D. mines, for example, seemed to be on a connected water-chanel, for cessation of pumping at any one of them increased the amount of water to be pumped by the others. Originally the upper level of ground-water was struck at 9500 ft. altitude, in seven or eight years it was lowered to 9050 ft., that is, 450 ft. of the water-zone had been removed by adits and pumps; the water-level then stood at 9050 ft. above the sea or 700 to 750 ft. below the surface of the ground

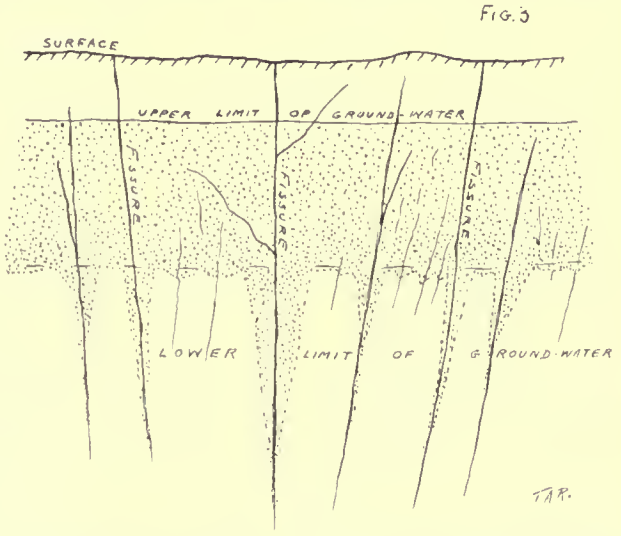
FIG. 2.



at Cripple Creek. Apparently the deep shafts were below the water-zone, for while it had required the pumping of 107,000,000 gal. to lower the general level one foot, it now needed the pumping of only 44,000,000 to achieve the same result. In the Independence mine water was struck at 370 ft. and the maximum flow (900 gal. per min.) was noted at 570 ft. Below that point the mine became less wet and in 1903 when it was 1400 ft. deep, the shaft was 'making' only 100 gal. per min. despite the fact that down to 900 ft. this shaft was connected with 16 miles of workings.

In the Rocky Mountain region generally it is usual to sink shafts after the first frost, because seepage from the surface then ceases; the wet season in the mines is during the early summer, when the frost is out of the ground and the water from melting snow penetrates through the upper workings into the deeper levels. Bernard MacDonald, formerly manager of the Le Roi mine, states that at Rossland,

FIG. 3



in British Columbia, during the spring (from March to July) "the water in the mines increases about 30% *over* the annual average" and in the dry season (August to October) the flow "decreases to about

25% *under* the annual average." This emphasizes the superficial origin of the water in mines. Moreover, in the desert regions of Arizona, Africa, and Australia the mine workings at a depth of 800 or 1000 ft. are actually *dusty*. In Western Australia the ground-water level was encountered at 40 to 50 ft. in many shallow prospects that I examined, but in the large veins of Kalgoorlie water was struck at from 75 to 100 ft., the maximum inflow was at about 600 ft., and at 900 to 1000 ft. there was no water. Even at a greater depth there would be (according to W. A. Prichard) sudden inflows due to boring into a watercourse, but such flows were brief and stopped suddenly, indicating their restricted character. They were the elongated V-shaped depressions of the water-zone such as are shown in Fig. 3. At Rossland, according to Bernard MacDonald, water is encountered at 25 to 50 ft. and the inflow increases up to a depth of 200 to 350 ft. Below 350 ft. the decrease is at first gradual, then with added depth it becomes rapid until at 900 ft. there is only a slight seepage, and below 1000 ft. the workings are dry.

In most mining districts the shafts sunk at a later date find the water-level farther down. Only the first shafts strike the water at its original level; for each successive drainage adit depresses the water-level and each mine that goes below the water-zone acts as a sump to collect water from the adjoining area. In the Morro Velho mine, in Brazil, the new shaft sunk alongside the old cave workings was absolutely dry, care having been taken to remove the water (coming down through the old excavations) by means of a bore-hole. At Monte Cristo, in Washington, the top limit of ground-water (according to J. E. Spurr) coincides with the surface, that is, the water-zone is immediately under the surface, for it is a region of abundant rain and the ground is full of joints. Mr. Spurr estimates "the depth of the surface zone of maximum water circulation" at less than 250 ft. In the Lake Superior copper district, there is "practically no water below 1200 ft.," as I was informed by Mr. W. A. Parnall, of the Tamarack mine. In sinking the Tamarack shafts, two of which are 5000 ft. deep, it was necessary to send down water for drilling. The maximum inflow of water is between 600 and 900 ft., usually at 700 ft. from the surface. When No. 5 shaft (vertical) of the Tamarack cut the Calumet conglomerate lode (dipping at 38°) at a depth of 4250 ft., the lode was found "very dry." The surface water follows the workings of the Calumet & Hecla down to the deep levels, but a new drift in virgin ground soon gets into dry rock. In the Atlantic mine three-fifths of the water is "taken up" at the seventh level, that is, 450 ft. below the surface. Many of the mines were started in swamps and these serve to collect water each spring. The water of the Lake Superior mines is rich in chlorides of lime, soda, and magnesia. These salts are probably derived from concentrations in the sandstones overlying the copper-bearing series to the west, that is, on the hanging-wall side. It is supposed that descending waters dissolve the more soluble calcium chloride first, and then the less soluble sodium chloride. They are carried by gravitative stress to the deeper horizon of the underlying trap series in which the copper is found. Even the wells near Houghton show the presence of chlorides and bromides.

In a district like Butte, where three or four successive periods of movement have caused intense and repeated fracturing, the water-zone has been depressed and the mines are wet down to 2000 ft. or even deeper. Furthermore, where, in a mineralized region, there has been faulting on a big scale, so that whole blocks of ground have been lowered, the result would be to depress the water-logged area and to permit of meteoric waters reaching an unusual depth. Emmons, writing eight years ago, ascribed the unusual secondary enrichment of the Butte veins to a rise in the water-level (and a depression of the former oxidized zone) of from 1000 to 2000 ft.,[2] this change of level being due to a regional fault.

To the miner, whose operations are limited, the belt of ground-water will appear as a zone of relatively large depth; to the geologist, who views the matter on a bigger scale, the zone will appear as a thin blanket, the top of which is approximately smooth while the bottom is very ragged. Under the water-zone is an indefinite region of dry rock and somewhere below it at an unknown depth is the source of the magmatic waters. These do not rise from gravitative stress nor are they a continuous portion of the ground-water, there is a hiatus between them and the reservoir of meteoric water; so that the old conception of rainfall descending into the earth at one place and circulating downward until by heat and pressure an upward movement was induced, is now no longer tenable, save in a restricted sense. We have a blanket of cold meteoric water, then a region of dry rock, penetrated by fractures, which become tight not far below the deepest mine workings, then still deeper upwelling hot mineralized waters of magmatic origin. As these ascend through fractures caused by movements resulting from volcanic action, or by dislocations due to readjustments of the earth's crust, they penetrate finally, near the surface, into a layer, zone, or belt of cold water, which has come from the surface and is charged with oxygen.

Having regard to the facts disclosed in mines, it seems to me that the theoretic curves illustrating the flow of underground water are fanciful and misleading. The idea that gravity is the only force to account for the circulation of the waters producing ore deposits is untenable, for there is a separation between the meteoric waters and the magmatic waters. The meteoric waters descend from the surface and accumulate at the water-zone, to be returned to the surface in places in the form of springs and artesian flows. The magmatic waters are presumed to originate at a great depth, whence they ascend with a loss of identity due to diffusion and chemical interchange during their passage through the water-zone. There has been a lot of lovely theorizing in disregard of the facts disclosed in mines and until these facts are properly accounted

[2] 'Genesis of Ore Deposits.' Page 445.

for our explanations of ore formation are bound to be incorrect.

The records of mining prove that ore deposits are non-persistent in depth, though sufficiently continuous to serve as marvelous treasuries of metallic wealth. While the deepest mines are not all non-productive, there is no known ore deposit of which it cannot be said confidently that the mechanical ingenuity of man is likely to be able to enable him to go deeper than the ore will persist. Having regard to the size of the earth, having regard even to the relatively thin section of it represented by its geologically known exterior, this depth of ore deposition and mining is insignificant. All the evidence is in favor of the essentially superficial character of ore formation; in other words, the precipitation of ore, and especially the concentration that makes the richer bodies of it, is measurable from the surface accessible today and has been affected by geological conditions near that surface. Of these conditions the most important is the existence of a blanket of meteoric water charged with oxygen and salts leached from the oxidized zone overhead.

This is not the time, nor is there space, for me to refer to the changes in the mineral composition of veins from the surface downward, but I venture to say that if the successive changes in the component minerals of ore deposits were investigated, there would be plenty of evidence to link the water-zone with the variations observed at different horizons. Whether my explanation be correct or not, it is quite certain that significant facts observed in mining have been overlooked by many leading authorities, such as Posepny, Van Hise, and others who have written lengthily and wisely on the subject of ore deposits. Until the known facts concerning the distribution of water underground, within the region penetrated by the miner, are explained so as to harmonize current theories with these facts, and not the facts with the theories, we shall make no sure progress in the elucidation of the problem. In any event, it is safe to say that no mining engineer investigating a particular district and endeavoring to ascertain the probabilities of persistence of ore in that district, can arrive at any safe conclusion until he has ascertained the position of the water-zone, its extent, and the part it has played in favoring those secondary enrichments upon which man depends mostly for his store of metal.

T. A. RICKARD.

San Francisco, June 10.

The Rights of the Miner.

The Editor:

Sir—Having been a prospector myself, I speak from first hand in disagreeing with Mr. Van Wagenen in some of the points raised in his recent article on 'The Rights of the Miner', appearing in your magazine. There is much to be said on both sides of the question of extra-lateral rights, but I take it to be a question which chiefly concerns the mine-owner and not the prospector. The apex law has led to endless litigation in the United States, and made such a mess of things in Canada that everyone was heartily tired of it and glad to see it repealed. As far as I know, the large majority of Canadian mine-owners are perfectly satisfied with the present law of vertical boundary planes. If the prospector makes a good find he can sell it, irrespective of any limit the law may set as to following the ore in depth. If he wishes to protect himself he can stake an extra claim in the direction of the dip of his orebody, though one would think a width of 1500 ft. would be ample. That the square boundary law does not deter prospectors from exploring the mountains of Canada is shown by the fact that there are hundreds of them in British Columbia alone. I do not understand how Mr. Van Wagenen could make such a statement as: "There is not a prospector in the whole of the British Northwest." As a matter of fact, there is a big rush on at this time for the Skeena River country, and it is not only the placer gravels on Findlay river that are attracting the adventurers, but as the new line of the Grand Trunk Pacific through Yellowhead Pass to Prince Rupert will open up a large mineral belt, prospectors are busy all the way from the head of the Columbia to the Peace river, looking for silver, lead, and copper, and several very encouraging finds have been reported. There are numbers of prospectors in even such an old established community as this. At the first signs of warm weather last month fully half our mine crew deserted us and went into the hills prospecting. The Canadians should do away with the Miner's License Act and lessen the burdensome taxation on ore shipments. In the United States something could be done to aid and protect the legitimate prospector by putting a crimp in the activities of the 'pegger'. The latter is an abomination. He is a man of no knowledge of mines or minerals; as a rule an ex-barber, shop-clerk, or bar-keeper who follows on the heels of the prospector and, smelling a 'strike' from afar, rushes in and stakes the rest of the county. In Nevada no attention is paid to the law requiring that mineral be found in place in order to originate a valid location, and the liberal Nevada law allowing the locator to remove the equivalent of the usual 10-ft. hole, that is, 240 ft., any way he chooses to dig it, has led to absurdities. At Bullfrog I saw four claims staked out on the flat sands of the Amargosa desert, each decorated with what had the appearance of a croquet court, the pegger's 'location hole' 12 by 20 by 1 ft. deep. In California matters were even worse. It having been reported that the famous 'Shorty' Harris had struck it rich in the Panamint range, a great crowd poured out of Rhyolite, crossed Death Valley, and staked the whole of the Rosebud district within a week. As the California law (or rather, lack of it) required no location work whatever, men staked as many as 40 and 50 claims, and legitimate prospecting in the district was killed for the remainder of the year 1905 and all of 1906.

The pegger or 'pencil prospector,' as he is sometimes called in the Southwest (his common Nevada name would not look well in print) certainly needs squelching, and the real prospector should receive every aid we can give him. J. V. RICHARDS.

New Denver, B. C., June 4.

COBALT, ONTARIO.

Written for the MINING AND SCIENTIFIC PRESS
By H. B. SMITH.

Since the first discovery of ore at Cobalt, during the construction of the Provincial railroad in 1903, many changes have been wrought in the appearances of the district. The country around Cobalt is a rocky glaciated area, dotted with numerous connected lakes. The whole region at the time of the discovery was covered with green timber, which had grown up since the lumbermen removed the virgin forest some twenty years ago. Since mining operations started upward of 1500 acres have been cleared in the vicinity of Cobalt, Glen, and Kerr lakes. The rocks of the district are covered in many places by glacial drift, but this is seldom more than a few feet thick. In the flats between the hills, swamps are frequent and must be drained before prospecting can be attempted. The energetic competition of the early prospectors is well illustrated by the accompanying cut showing multiple locations, the stakes indicating the number of locators laying claim to one mineral discovery. As many as 40 men were simultaneously prospecting this claim, which became the property of the one who made the first discovery of mineral that would pass the government inspector's examination. A claim consists of 20 acres.

The general method of prospecting is as follows: Trenches are run in various directions and the surface of the rock cleaned and prospected as the trenching progresses. The digging is usually done by Italian laborers, while an experienced prospector follows them up, cleaning and carefully examining all cracks and joints for mineral indications in the rocks uncovered. During the summer of 1906 the Nipissing Mines Co. attempted to substitute hydraulic sluicing for the slow trenching method of prospecting, and a pumping station was established on the shore of Peterson lake. A centrifugal pump furnished the water for the operations, which were directed against the slope above the lake. This method was soon abandoned, but not until after several new veins had been exposed. The New Vein in the Nipissing is shown in the accompanying cut. The two picks held by the engineer indicate the width of the vein. The sacks of ore reveal that it is sent to the smelters for treatment.

The almost vertical veins of the district range in width up to about 20 inches. The extent of these veins has not been fully determined, as few have

The Lawson Vein.

New Vein in Nipissing.

Multiple Locations.

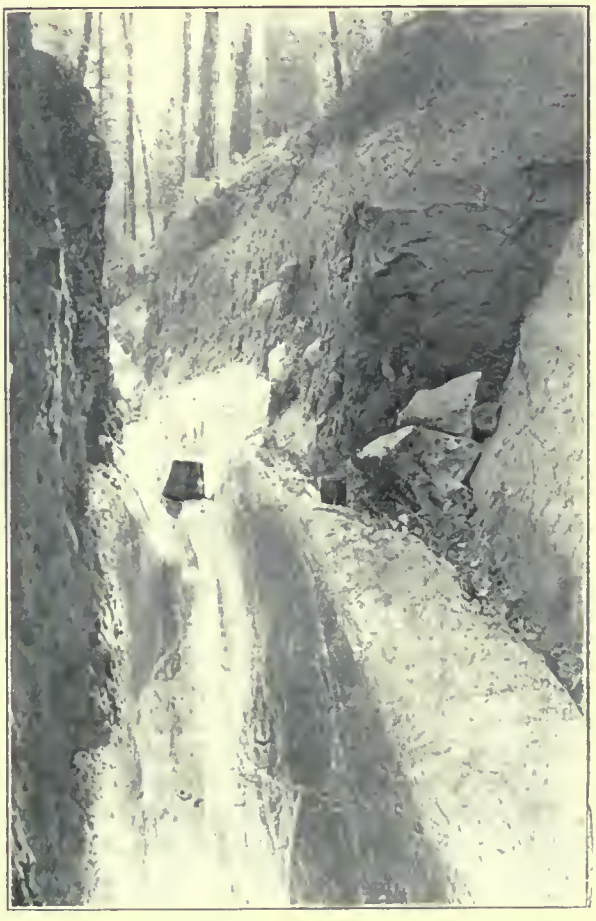
been uncovered for more than a short distance. Some branch out into veinlets and are lost, or pinch out and may be picked up farther on. In places the veins follow the warped course of the joint-planes in the country rock. The principal constituents of the ore are native silver, argentite, and argentiferous smaltite, but native bismuth and niccolite also occur in most of the deposits. In a few veins the cobalt and nickel minerals are found with little or no silver, as in one vein of the Nipissing Mines Co. on Cobalt hill. The gangue material is calcite, but it is usually found only in small quantities. Quartz gangue is rare. The absence of the sulphides of the base metals

Calcite Vein, 12 to 16 Inches Wide. The Striations and Grooves Are Due to Glaciation.

in the vein-filling is a rather singular fact. Chalcopyrite, galena, blende, and pyrrhotite occur in veinlets and flats in the country rock, but even here pyrite seems wanting. These veinlets are older than the silver-cobalt deposits.

Most of the rich silver veins of the district are in the Lower Huronian formation. A hill of Lower Huronian is shown in one of the cuts herewith. It is Lot 401 of the Nipissing property. A narrow dike of dark diabase cuts the hill at right angles to what appears to be a fault-scarp, at the foot of the man shown in the photograph. Note the anticline on the right. At the base of this formation is a banded slate on which rests an impure quartzite, in turn capped by a conglomerate member. The Lower Huronian formation rests on the older Keewatin series of greenstones, which outcrop in a few localities in the producing district and in a few instances contain rich silver veins. Vein No. 26 of the Nipissing Mines Co. is an example of a rich silver vein in the Keewatin, while the veins of the Green-Meehan Mining Co. in the township of Bucke are

Hill of Lower Huronian Conglomerate.



A Vein in Diabase or Gabbro, Showing Depth of Drift Covering.

other examples. At shaft No. 6 of the O'Brien mines, a rich silver vein in the diabase has been cut at the 100-ft. level by both east and west drifts.

The weathering of the vein matter in some instances has reached a depth of 15 to 30 ft., while at other points little or no alteration of the filling is observed. It has been suggested that very little alteration has taken place since the glacial period and in support of this view attention is directed to

the native silver outcrop on the Lawson property, where the native silver and country rock alike still show distinct glacial striations. The Lawson vein carries from two to eight inches of bright native silver, also exhibiting marks of glaciation. The removal of the overburden of drift has exposed the vein, which is seen in the bedrock. This vein has been involved in litigation.

Up to the close of 1906 the ores of the district were won by underhand stoping in open-cuts, but at the end of 1906 many shafts were put down, power and hoisting plants were installed, and at present the wasteful open-cut method of mining has been practically abandoned. More than one mine is pumping extra surface water now owing to these old workings. In the open-cuts hand-drilling was resorted to, and even now shafts are sometimes sunk by this method, but air-compressors, from 5 to 20-drill capacity, have been installed throughout the district and all underground work is done by machine-drills. A number of hoists are also run by compressed air.

The typical shaft in the district is 5 by 8 ft., inside measurement, with a hoisting compartment, fitted with a cage, and a ladder-compartment which also contains the air, steam, and water-pipes. Two-compartment shafts, as well as adits, however, are also found in the district. The ore is hoisted from the mine in cars and trammed to the 'rock-house,' where it is washed and hand-picked into three grades. The first grade will usually run over 2000 oz. per ton; the second grade, over 150 oz.; the third grade is under 100 oz. per ton. The first two grades are sacked for shipment to the smelters, while the low-grade ore is piled on the dump. Many of the miners now either have mills in operation or under construction, and several custom mills have also been built to concentrate dump-ore. The ores for the most part have been shipped to the Canadian Copper Co.'s smelter at Copper Cliff and to the American Smelting & Refining Co. at Perth Amboy, but shipments have also been made to the Balbach Smelting & Refining Co. at Newark, N. J., to the Deloro smelter in Ontario, to Denver, and to the Vivian works at Swansea, Wales.

Aside from the power-plant, shaft-houses, blacksmith shops, magazine, and office, each mining company has a bunk-house and boarding-house where the men are furnished with room and board at 60 cents per day, which amount, along with a 50-cent per month hospital fee required by the Provincial Government, is taken out of each man's check on pay-day. Both board and bunk-houses are found in various stages of perfection at the various camps in the district. At some of the mines the comfort of the men is so far considered that iron beds with springs and mattresses, in plastered, steam-heated rooms, are furnished, the building is furnished with electric lights, hot and cold baths, and ice-water is always on tap.

The town of Cobalt spreads over large area along the hillside overlooking Cobalt lake from the north. Here two large modern hotels, the 'Prospect' and the 'Cobalt,' provide for the welfare of the traveling public, while three banks furnish connections with the financial world. The rocky surface at Cobalt makes the maintenance of sanitary conditions impracticable, and in view of this fact a new town-site, called Argentite or North Cobalt, has been cleared on the edge of the clay belt two miles north of Cobalt station, and here sewage and water-works systems and a systematic arrangement of buildings is to be enjoyed. North Cobalt will be reached both by rail and by the new King's highway which connects the various mines with the railway stations at Cobalt and Hailibury.

STANDARDIZATION OF BULLION AND ASSAY VALUES.

The Committee on Bullion and Assay Values appointed by the Institution of Mining & Metallurgy (London) requests opinions and arguments upon the following points:

1. Do you approve that, wherever possible, assay values of gold and silver ores and products shall be reported in ounces and decimals, or pennyweights and decimals, rather than in ounces, pennyweights, and grains?

2. Do you approve that assay values of alluvials shall be reported in grains and decimals of a grain of 'fine' gold, or in pence (at 2d. per grain of 'fine' gold) or cents per cubic yard or per ton? If reported per ton, should one cubic yard of ordinary damp alluvial, excluding boulders, be taken as equivalent to 3000 lb.? If not, what do you recommend?

3. Do you approve that in cases where money values are given for assays of silver, copper, tin, and other metals whose value fluctuates, the market price of a stated quality or brand of the metal, as taken for calculating such money value, shall be given, together with the assay value in ounces, etc., per ton, or in per cent or other concrete quantity?

4. Do you approve that in reporting assay values of cyanide or other solutions, results shall be reported in ounces or pennyweights, etc., in a stated *volume* of such solutions, or do you prefer the use of the ton of 2000 lb. instead of volume?

5. Do you approve that in reporting assays of silver and gold products and ores, the assayer shall state on his certificate whether the slags have been 'cleaned' and allowance made for cupel absorption?

6. Do you approve that all assay reports shall state the exact condition of the sample as to dryness, when assayed?

The above questions are merely given to facilitate the collection of opinions. Any additional suggestions, and criticisms on those outlined in the letter attached to this form, will assist the committee in arriving at a decision.

Atomic weights of certain common elements recently revised by a committee of the American Chemical Society are found to be as follows: Ag, 107.88; N, 14.037; K, 39.1135; S, 32.113; Pb, 207.19; Te, 127.609; Ra, 226.18. The Chemical Society (London) announces the atomic weight of Indium, printed in error last year, as being 115.00.

RECENT MINING WANDERINGS IN BURMA, CHILE, AND BOLIVIA.

Written for the MINING AND SCIENTIFIC PRESS
By J. H. CURLE.

On my way to inspect the property of the Burma Mines, Railway, & Smelting Co., I arrived in October of last year at Mandalay, in Upper Burma. Finding there the general manager, H. C. Hoover, and the manager, C. D. Clark, ready to start on the expedition we had previously planned, we got off without delay.

The genesis of the Burma Mines Co. was the discovery, in the vicinity of an old Chinese-worked silver mine, of dumps of lead slag. In 1904 these dumps were reported on by C. S. Herzig, who figured that they bulked about 115,000 tons, contained 48% lead, and were readily smeltable; hence the formation of the company in London.

Our expedition left the railway a few miles short of the small town of Lashio, its terminus. We were now in the Northern Shan States, the Chinese frontier lying some 40 miles to the east. Where we got off the Government railway, we saw the commencement of the 2-ft. line being built by the Burma Mines Co. to connect the Government railway system with the slag dumps, 50 miles north. We found the rails of this narrow-gauge line laid for five miles, and stretches of earthwork for 40 miles, but I could see that a good deal of work remained to be done. In the flotation of the Burma Mines Co. too little cash was provided for building the railway. This seems to be an initial error nowadays in all new mining ventures. In the present case, those in control no doubt thought that for a 2-ft. line, merely to run down 115,000 tons of slag, any sort of makeshift would do, and they provided accordingly. They forgot, perhaps, that the whole distance was through hilly country, and in dense jungle, and that for several months each year the road-bed and cuttings lie under torrential rains. These initial mistakes have cost the company a year's delay in reaching its slags, likewise the raising of £40,000 further capital for the more substantial completion of the line. The transport question, altogether, is the weak point here. The slags have to be hauled to Mandalay to be smelted. Assuming the Burma Mines Co. gets its 50-mile line in order after each rainy season, and delivers the slags at the junction, it is still in the hands of the Government railway, which must carry the material the 200 miles into Mandalay. But that concern is not yet equipped for hauling ore, and has intimated that it cannot handle more than 90 tons daily. As the smelter capacity at Mandalay is 200 tons daily, and as estimates were based on this quantity being handled, it is to be hoped that the Government of Burma will be induced to put pressure on the railway authorities.

After passing for some days through dense forest, we came out onto hill-tops, devoid, except for grass, of the slightest vegetation. For several miles around the old smelters, the Chinese had cut down every tree for fuel, and it seemed strange that though this was done many decades, or even centuries, ago, nature had not replaced the forest growth. This was Baudwen, 'the silver mine,' and in the valley below us we could see the dumps. This valley was at one time a prosperous Chinese mining republic. We found the ruins of a temple, and of rows of stone-built shops, and the remains of numerous small furnaces. Farther up the valley, landslides, covering many acres, point to where ore to the extent of millions of tons has been mined. Tunnels of more recent date have tapped orebodies on the confines of this caved ground; some of these carry fair lead ore, but they do not seem of great size. The extension in depth of the main orebodies will have to be determined by drilling; but whether this will show that the Chinese stopped because they had taken out all there was of value, or because of water trouble, I do not care to guess. At any rate, there is the chance of finding a mine, which, if it contains high-grade silver-lead ore, would be an asset after the slag-dumps have been beneficiated. Local tradition says the Chinese have not worked Baudwen for 60 years; then, perhaps, discontinuously. I should imagine the days of its splendor to have been several hundred years ago. The fact to grasp now is that there are some 55,000 tons of lead (in the form of 48% lead slags) lying in the valley ready to ship, and that the company expects to begin this work late in 1908. If lead is at a good figure for the next two years, it will make a large profit. The company has erected its own smelter at Mandalay. It will get coke from England and India, and has good fluxes locally. The transport question is the weak point, but it does not appear insuperable. With good prices for lead, and the finding of pay-ore under the old workings, the Burma Mines Railway & Smelting Co. ought to be a successful venture. It is certainly a deeply interesting one.

Report spoke of there being more slag-dump some 30 miles north of Baudwen, and I determined to examine these. Hoover and Clark having to return to Mandalay, I got W. A. Freymuth, one of the railway engineers, who speaks Burmese and Chinese, to go with me. The third evening we pitched our tent on Mo Ho Tchwang, the Chinese named mountain on the slopes of which the dumps were said to lie. Here, as at Baudwen, was evidence of old smelting work, for the upper part of the mountain lay bare of trees; we could see, too, on the other side of a steep valley, the outline of a big dump. Next morning we put a dozen natives to cut a path to this, through dense bamboo shoots 6 to 10 ft. high, and in the afternoon reached the dump—to discover it was all waste rock, evidently material rejected by those in charge of the furnaces. However, from this spot we could see a number of dumps lying on both sides of the valley, which really were lead slags, and in the course of four days, though not without much path-cutting and hard work, we found over 20 dumps. We also found several adits running into the mountain, into which we did not venture, but there was no 'caving' of big areas as at Baudwen. Many of the dumps were on the opposite side of the valley from the adits, a full mile distant, and higher up the slopes, and as they were mostly overgrown with vegetation,

it was no easy matter to find them. I figured by rough measurement that we saw not less than 50,000 tons of slag, and that there is probably more which we did not find. This Mo Ho Tchwang slag appeared to me to be one-third lighter than that at Baudwen. I took a sample back to Mandalay and arranged to have the analysis forwarded me to London. Subsequent cable advice gave the lead content at 25%, but I had left England again before the full analysis arrived. I think it probable that there is an excess of zinc in this slag, a fact which, combined with the low lead-content, will, I am afraid, cause it to be unpayable in that locality.

Leaving Mo Ho Tchwang, we traveled by mountain paths from one village to another, and after 120 miles reached Bhamo, on the Irrawaddy, whence I sailed by river-steamer to Mandalay and Rangoon, and so to England. I am not prepared to say that Upper Burma is to become a mining country. The slag-dumps of Baudwen and Mo Ho Tchwang are the only ones known, and it is doubtful if similar deposits of silver-lead-zinc ore, if found in those regions, would pay under present-day conditions. There is a little gold dredging on the Irrawaddy, far above Bhamo, but as yet with no real success; several placer areas are known in other parts; but Upper Burma is in no sense a rich goldfield. Forest and dense vegetation cover nearly the whole country, so that prospecting is hardly possible, while the lack of roads, and the remoteness of most of the country from rail or navigable river makes the transportation question most serious. A deadly malarial climate is another point for consideration; it nearly killed me before I reached Bhamo.

I got back to England on the last day of 1907. On January 16, 1908, I was off again—for South America—and in February, after crossing the Andes from Buenos Ayres, came to a short halt in Chile. That country I found in the throes of a financial crisis, brought about in part by the recent fall in metals, mainly copper. From one end of Chile to another copper mining has received a staggering blow, and from Chuquicamata on the Antofagasta railway to Cutter Cove near the Straits of Magellan, mines and prospecting ventures have been closed down wholesale. Chile is not fortunate at present in its mining. Some years ago a considerable gold dredging industry was started in the far south, and about a dozen dredges were installed, one or two on the mainland near Punta Arenas, the rest on the other side of the Straits, in Tierra del Fuego. But I believe I am correct in stating that not one of these dredges has earned a commercial profit, that most have run at a loss, and that this industry is slowly going the way of so many other dredging schemes. The most promising gold venture in these regions, if its Santiago directors can keep its finance sound, appears to be on Lennox island, 40 miles northeast of Cape Horn. Here, on the beach, a 10-in. suction-pump dredge has been built. The manager, A. Richardson, with Australian and New Zealand dredging experience, tells me he has proved at this spot 1½ million cubic yards of gravel worth 1s. 3d., and in another locality 4 million cubic yards worth 10d. When he starts work this will be the most southerly mine in the world.

Chileans, as a nation, are not fit to handle serious mining ventures. As practical mining men they are mostly futile, and their real interest in the industry begins and ends on the stock exchange. Last year a Bolivian tin mine, called Llallagua, was purchased by Chilean capitalists, floated in Santiago for over £400,000, and the shares were widely bought all over the country. This Llallagua, which I inspected some weeks ago, is probably the richest tin mine in the world at present. The Chileans, who, like the Bourbons, learn nothing from experience, sent a Chilean manager to control this venture. This worthy, for pure incapacity, would be hard to equal; for, though handling the richest tin mine in existence, with tin at a high price, he ran the company into a loss of well over £100,000. The enormous staff of Chileans under him were robbing the company at every turn. In desperation, the directors got rid of this man and appointed as manager an Englishman long resident in Chile, W. T. Holberton, late manager of the Copiapo Copper Co. His first act was to discharge 57 men from the staff, parasites of manager and directors (I am ashamed to say there was an Englishman among them), who were doing no work and were drawing fabulous salaries and commissions. In his first six months, with tin at lower prices, he has paid off £40,000 of the debt and developed big ore reserves. No doubt in due time he will free the company from debt, erect a decent concentrating plant, and start to earn large dividends. My only fear is that then the Santiago people will forget that a foreigner dragged them from the mine, will again place the company under Chilean management, and will re-start their stock exchange manipulations. Keep clear of the Chilean in mining matters, is my advice.

To get to Bolivia from Chile you must travel by the English-owned railroad from Antofagasta to Oruro. The distance is 924 kilometres, and the journey takes three days, traveling by day only. This line, with a 0.75 metre gauge, handles a big traffic. It runs through rich nitrate deposits, and beyond there is a great lake of borax—better than anything I saw in Death Valley, California. This is being worked on a large scale. There are also branch lines to several copper mining districts in Chile, and to the famous Huanchaca silver mine in Bolivia. This railway knows how to charge. Anthracite coal, for gas engines, costs £10 per ton in Oruro; the original price of machinery is doubled when it reaches here; and the freight on tin concentrate to the coast is £5 9s. 6d. per ton. The mining industry of the Bolivian highlands is largely at the mercy of this railroad, and it abuses its power. There is a continual block of freight-traffic at Antofagasta, and it frequently takes months to deliver anything after it has reached that port. Thefts, too, and losses, are common down there, causing serious delay and expense to the distant mine-owners. To this railroad also belongs the unenviable record of allowing its passengers to be provided with the filthiest food served at any railroad eating-houses in the world. Bad food, that is to say nearly all meat, and that

badly cooked, is the keynote of life on the Bolivian plateau. To make up for this, most of the English-speaking residents, who number several hundreds, drink inordinately, and many thereby come to grief. It is a country of crude methods. If you travel, you can only ride on mule-back, and over rugged mountain trails, carrying provisions, mattress, and blankets on a pack-mule, and covering 15 leagues a day. At night you turn into a mud hovel in some Indian village; at daybreak you are glad to be out of it and on the road again. The climate is good, with a rainy season from December to March. In winter the nights are very cold, although in the tropics. Oruro is 12,200 ft. high, and other mining towns range from 12,000 to 14,000 ft. Young men, coming from abroad, can stand this altitude, but a man over 50, or a man with a weak heart should not come to Bolivia. As is so often the case, where the conditions of life are unpleasant, the mines are rich. I had always thought Bolivia one of the richest countries in metals; now I have seen it to be so. With more railways and cheaper freights, this country would make a wonderful showing with its mines. At present Bolivia mainly subsists on tin mining, with an expanding output year by year, that for 1907 being figured at 16,600 tons pure metal. Huanchaca produces a lot of silver, and some comes from Potosi, Colquechaca, and Oruro. The Coro Coro district produces native copper. Gold is known in various places, especially on the lower eastern slopes, in unhealthy country, but apparently is being worked only in placers by the Indians. But tin is *the* metal in Bolivia at present. All other metals exist, probably in great quantity; but prices are low, transport bad, railway rates prohibitive, and no one thinks of prospecting for or developing anything else.

The tin lodes exist in a belt some hundred miles long, that is, from north of La Paz to near Tupiza. I believe that all of these lie higher than 12,000 ft., while Chorolque is 17,400 ft. and Santa Barbara is reported as over 18,000 ft.; the last being no doubt the highest mines in the world. I have no exact idea how many tin lodes are being worked in Bolivia, but it seems to me that for every lode already found, there must remain several unfound. For example, standing on the Llallagua mountain, in which exist several rich lodes, I saw, within the radius of a few miles, a dozen other mountains in each of which one would be justified geologically in looking for similar mineralization, although as a matter of fact in none of these is tin known to exist. There is no doubt that this district has been well prospected, not only by the Spaniards, who appear to have been thorough prospectors, but in recent years, since the discovery of the Llallagua mines. This raises the question of the existence of 'blind' veins in the Bolivian mountains, and as to whether it would be profitable to drive adits into many of these on the chance of striking lodes which do not outcrop. I am of opinon, so rich do I believe the mineralization of this belt to be, that such a course would lead to many discoveries, and that it is worth the serious attention of English and American capital. The tin lodes of Bolivia are as a rule of high value. From 5 to 15% of metal is not unusual, and from a number of mines a portion of the lode is shipped as broken, that is, it runs better than 60% metal. There are no accurate costs pertaining to this industry. These are only quoted as per ton of *barilla* (concentrate) recovered, and such items as the tonnage and value of ore in place, the number of tons treated each month, the quantity of slime produced, and the value of slime and tailing, are never procurable. Costs, in any case, are necessarily very high. Indian labor is not too plentiful, but is good. Feast days and bouts of drinking excepted, the Indian puts in good work, and receives from $1 gold per day upward. Supervision is carried on in some mines by Bolivians, in others by Europeans, Cornishmen predominating among the latter. From all the bigger mines the ore is shot down by aerial ropeways, some of these being four to five miles long, and costing on an average £1 10s. per yard to erect; they appear to work well. Except just around Oruro all the crushing and concentrating plants have water, although this is, in places, scarce and used by several plants in succession. Concentration is usually preceded by crushing in stamps or ball-mills, followed by jigs and buddles. Wilfley or other tables are used in some plants, and in others they have been thrown out as being too delicate to be handled by Indian operatives. Hand-jigging and buddles constitute the favorite method; this is primitive, and requires an immense amount of re-handling, but with conditions as they are, is not so ineffective as one might imagine. A lot of slime is produced—possibly 30%. This is usually put over buddles, and the assumption is that half its tin content is recovered. I know of no mine doing any systematic sampling, either of slime or tailing, and cannot give figures as to losses in treatment; but no doubt the loss is not less than 30% of the total tin content. The concentrates vary from 55 to 70%, averaging just over 60% of metal; these are all shipped to England; anything below 62% is penalized by the smelters, and on a *barilla* of only 50% the penalties are almost prohibitive. From a mine close to Oruro, consequently on the railroad, the costs of realizing a ton of *barilla* work out as follows:

	£	s.	d.
Bags and bagging	0	16	6
Freight to station	0	11	0
Sundries at Oruro	0	1	10
Export duty (with tin at £140)	2	16	3
Rail to Antofagasta	5	9	6
Agency, etc., at Antofagasta	0	9	9
Freight to London	2	15	0
Insurance, agency, assays, brokerage, commission, and smelters, incidentals	3	10	0
Returning charge (for 62% *barilla*)	11	15	0
	28	4	10

From a mine situated far from the railroad a transport cost of several pounds per ton would have to be added to the above. The cost of producing concentrate varies too much to be included, but is on the same heavy scale. Bolivia is fortunate

in so far that its average tin mine is rich, and that tin keeps a good price, otherwise working and transport costs would be prohibitive. The key to the situation no doubt lies in the fact that the richer ground in the Straits Settlements is mostly worked out, and that the cost of producing tin there is going up all the time. There are still immense areas to be worked in the Straits, but it is believed that the produeing costs will be such that the market price of the metal will average more in the future than in the past, and that it will not again fall below, say, £120. It is a dangerous thing to prophesy metal prices, and I have no opinion on this point; the belief just expressed is that current among the mine-owners.

The most interesting mining field in Bolivia is the famous mountain of Potosí, rising to nearly 16,000 ft., or 2700 ft. above the considerable town lying at its base. Native silver was discovered here by an Indian, in 1545, and when the butcher, Pizarro, was building Lima, in the earliest days of Spanish occupation, his hatter was sent to extract wealth from these already celebrated mines. Here is still to be seen the Royal Mint, now in use by the Bolivian Government, and its wonderful wooden machinery of former days. The Spanish Government annexed 20% of all the metal as royalty and then for hundreds of years an increased revenue from this mountain. Potosi is covered with the dumps of hundreds of workings, and its interior is even yet a net-work of veins. Silver is worked to a small extent still, but tin mining is the chief industry. The Indian miner of Potosi, working 36 hours at a stretch, does his work on contract, receiving payment relative to the value of the ore he produces. I was told that he receives one-half the value; this seems hardly credible, but whatever the figure there is no doubt that the mining cost to the owners is enormous. Then there is transport. Potosi is 150 miles from the railroad, over many mountain ranges, and freight thither is about £5 10s. per ton. Coal being prohibitive, *gareta*, a native moss, is used for fuel, while charcoal costing £6 per ton comes from the interior.

To lighten cost of transport, some crude smelting is done at Potosi in small water-jacket furnaces. Tin bars, of 92%, are thus produced, the balance being lead, antimony, etc., and despite the cost of fuel a saving is made by shipping these bars rather than concentrates. Tin is being mined profitably at Potosi, by adits, at nearly 2000 ft. vertical below the summit, and may extend deeper. The geology of the lower part of the mountain, however, seems obscure; it is not yet penetrated by any deep workings. Leaving this in doubt, there must still be a vast quantity of silver and tin ore unexplored, or left behind from richer patches. But the titles to mines on the mountain are in a shocking condition, and the whole of these would have to be brought under one corporation, and that given a fresh title by Government, before foreign capital could come in here. Given such a consolidation of the Potosi areas, and a railroad, this mountain might again emulate its past records. Failing these factors, it will remain a field of many small enterprises, severely handicapped in its economic conditions.

There is as yet little evidence concerning the value of Bolivian tin mines at depth. As has been mentioned, those in the Potosi mountain carry their values down, but nowhere else have they been tapped so far below the outcrop. Most of the other mines are shallow, say less than 600 ft. deep, and appear to be still holding their value in the bottom. Sulphide ore is showing in a number of mines, which require calcining previous to milling, and as there seems to be no impoverishment in the sulphides I should say that the evidence of ore lasting to moderately good depths is favorable.

Bolivian politics are not inimical to mining, for the chief families of the State have made their wealth from mines, and this is the main industry of the country. The weak spot is the question of title, which may arise from original mistakes on the part of improperly qualified surveyors, or perhaps from the acts of corrupt officials. Many of the best mines are continually troubled by law-suits, and the courts are always full of cases dealing with validity of title. No doubt, with care in the beginning, and the services of an influential lawyer, much of this trouble over titles could be avoided. The worst feature in connection with Bolivian mines, from my point of view, is that they carry no ore reserves, the British-owned mines in this respect being as bad as those owned and run by natives. Llallagua, certainly, has a good reserve, but this is exceptional. Notwithstanding this lack of ore in reserve, the mine-owners won't sell under 10 years' purchase, and during the 'boom' of last year several were fortunate enough to get out on this basis to fool companies floated in Chile. It is useless going to Bolivia with the idea of buying a developed mine, for the careful mine-valuer will never see his way to offer more than one-quarter of the price demanded by the owner. Last year, when tin was booming, representatives of the Steel Trust and the American Smelting & Refining Co. scoured Bolivia for tin mines. Of course, they did no business; for they were men with reputations to lose, and they did not see their way to risk 80% of the purchase price in non-visible ore, and it will always be the same there. The best way to secure mines in Bolivia is to take up absolute prospects, or to drive adits in the hope of striking blind veins. If I could only stand the discomforts of the country, I would do this myself, for I am convinced of its great wealth—both found and unfound.

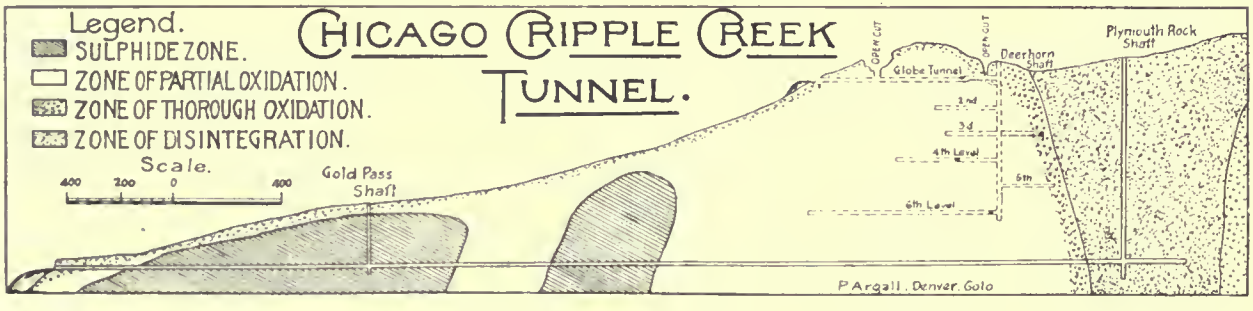
Silica is constantly being added to or subtracted from rocks within the zone of meteoric waters. Alteration is always progressing, unless there is entire absence of moisture. All meteoric waters contain carbonic acid, which comes nearer being a universal solvent than any other common substance. The solvent effect upon silicates is increased by carbonate of ammonia, which is always present in waters derived from rainfall. The process of dissolving silica from silicates is called carbonation, because the carbonic acid takes the place of the silica in combination with the bases.

ROCK OXIDATION AT CRIPPLE CREEK.

Written for the MINING AND SCIENTIFIC PRESS
By PHILIP ARGALL.

The deep and thorough oxidation of that portion of Globe hill extending in a southeasterly direction from the Summit shaft to about 100 ft. beyond the Plymouth Rock shaft, has received almost as much attention from geologists as that unique deposit of gypsum exposed in the Deerhorn shaft, forming, as it were, the core of this great area of oxidized and disintegrated breccia. The following description of the occurrence culled from extensive notes made during an examination of some Globe Hill properties in 1905 may prove of some interest in the study of thermal action and oxidation of rock-areas. It is a matter of regret that on account of the numerous caves in the deeper levels of the Deerhorn mine I was unable to obtain complete data, more particularly as to the extent of the gypsum deposit along its strike southeastward.

The oxidation of the breccia and other wall-rocks of the Cripple Creek district is seldom referable to the water-level at any given place, but is solely attributable to the facility offered for the circulation of meteoric waters in the joint-plane, cracks, incipient fissures, and veins in the rock-mass. This is clearly seen in the section of the Chicago & Cripple Creek tunnel. Taken in connection with the thorough oxidation of the breccia at the Deerhorn, and its disintegration and reduction to a mass of soft clay, this section affords an interesting study in rock oxidation and decay.



The portal of the Chicago & Cripple Creek tunnel is situated in Poverty gulch, close to the Abe Lincoln mine, at an elevation of 9700 ft. The adit starts in a thin band of schist passing in a short distance into the massive unoxidized breccia, which I shall, for distinctness, designate the 'sulphide zone.' In this zone the breccia contains pyrite in considerable quantity, well distributed throughout the rock. Where veins occur, pyrite is the principal mineral and it appeared to me that there was also a heavier impregnation of sulphides in the wall-rocks of the veins, but even where no veins appear, the joint-planes of the rock were covered with films of fine sulphides, mostly pyrite. This sulphide zone may be considered the unaltered breccia of the district, it is the prevailing rock in which the sulpho-telluride veins occur, and it is assumed to have passed through no particular change or alteration since the formation of the veins and the deposition of the ore.

About 1400 ft. from the portal the adit passes out of the sulphide zone and enters one of partial oxidation, simply the same breccia with open slips, or joints, small fissures, and shattered zones through which circulating waters oxidized the exposed rock-faces, often filling the larger open joints and small fissures with iron and manganese oxides. Where the rock is shattered into small fragments, the oxidation may be complete; usually, however, a piece of rock no larger than a man's fist when broken open shows a core of blue unaltered breccia with shining pyrite. This I shall designate the 'zone of partial oxidation.' It, of course, passes gradually over to the zone of complete oxidation when the pyrite in the rock-mass is all oxidized and the whole rock stained with iron and maganese oxides, either or both. Near the surface this rock is soft, but stained throughout with oxides and never shows the greenish blue of the breccia or phonolite groundmass. The zone of partial oxidation in the average Cripple Creek mine is usually reached at depths varying from 20 ft. to 150 ft. from surface, depending on the permeability of the rock-mass. The Chicago & Cripple Creek tunnel passed through 240 ft. of this zone of partial oxidation and again entered the sulphide zone, through which it passed for a distance of 400 ft.; here copper sulphate was detected in several places on the tunnel-wall resulting from the oxidation of sulphides since the adit was opened. An examination of the rock near one of the copper colorations revealed crystals of chalcopyrite, the first I had seen at Cripple Creek.

Emerging from the 400-ft. sulphide zone, the adit enters a second zone of partial oxidation, which was penetrated for a distance of 1500 ft. at an average depth below the surface of some 700 ft. (see section), but gradually becoming more oxidized; the next 100 ft. of the adit is in the thoroughly oxidized zone; next comes that peculiar product of Globe hill, a thoroughly oxidized and disintegrated rock which I shall designate the 'zone of disintegration.' At the time of my examination the tunnel was caved at a point slightly beyond the Plymouth Rock shaft after penetrating the latter zone for a distance of 120 ft. From the best information obtainable at the time, it appeared that the Plymouth Rock shaft had been sunk about 800 ft. in this loose disintegrated material, terminating about 60 ft. below the floor of the Chicago tunnel, the then water-level of this locality, and in the same loose material.

The disintegrated breccia around the Plymouth Rock shaft at the Chicago tunnel horizon is quite loose and soft, not unlike material that had filled a cavity. It contained much iron and manganese oxides.

some rounded lumps of kaolin, a little gypsum, and occasional pieces of barite; in places manganese oxide predominates and the material is not unlike a pile of loose ashes. The red oxides of iron so common in the upper workings of the Deerhorn are not plentiful at this depth, brown and black colors predominating.

We can now summarize:

(1) Sulphide zone.—The practically unaltered rock.

(2) Zone of partial oxidation.—The rock mostly oxidized on the faces, joints, cleavages, and fissures.

(3) Zone of thorough oxidation.—The pyrite all oxidized and the rock softened and stained with oxides, none of the original color being left.

(4) Zone of disintegration.—Rock thoroughly oxidized and disintegrated, reduced in fact to ferruginous clays and talc.

This last zone extends for a length of about 1000 ft. in a southeasterly direction from the Summit shaft to some distance beyond the Plymouth Rock shaft and Chicago & Cripple Creek tunnel. The distinguishing feature in the Summit workings is the great amount of kaolin, resulting from the decomposition of the feldspars, and its accumulation in the veins, fissures, and channels of disintegration. The pay-veins of the Summit mine occur in the zone of thorough oxidation and when followed southeasterly they disappear in the zone of disintegration near the boundary of the Deerhorn claim.

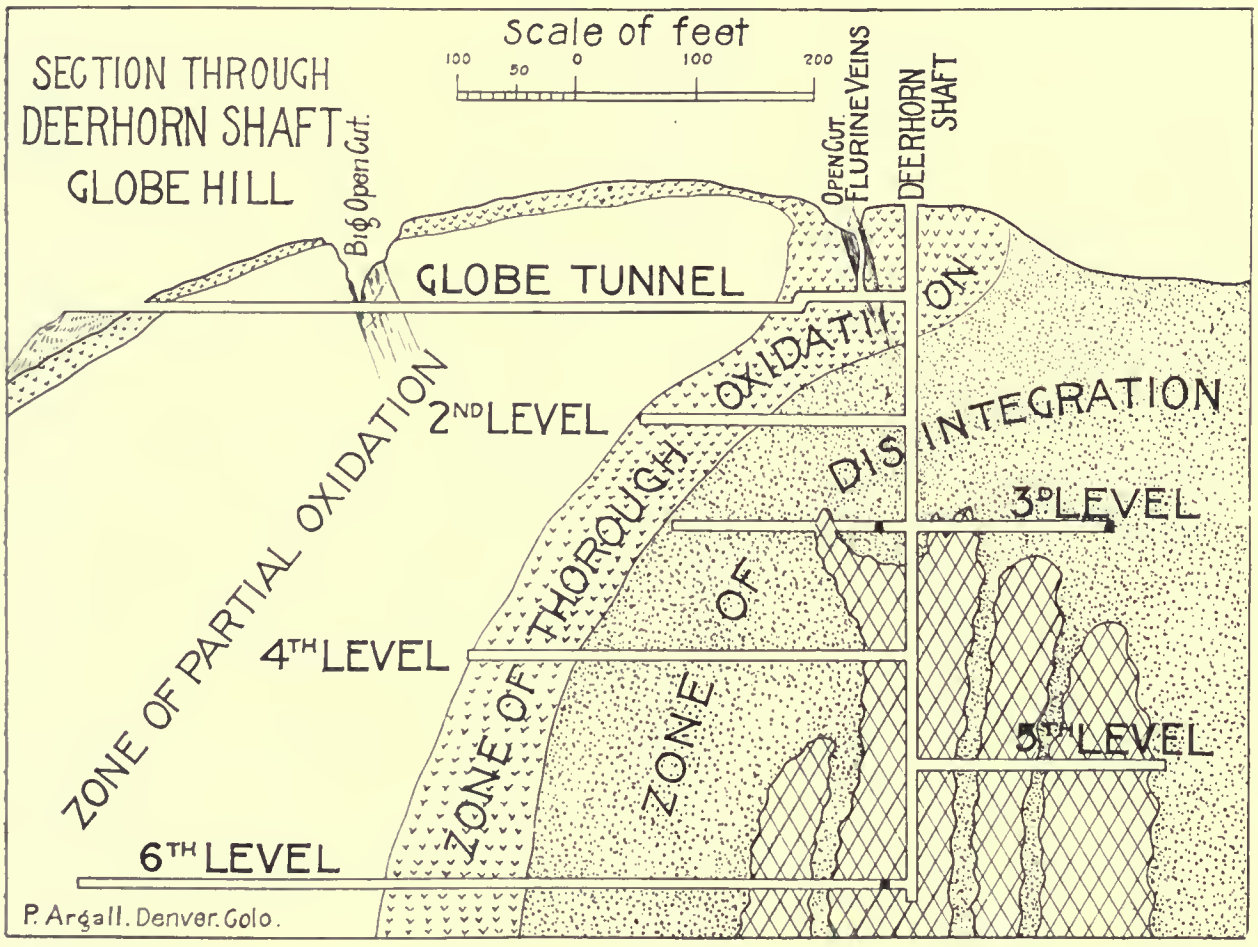
On referring to the section through the Deerhorn shaft, it will be noticed that the zone of thorough oxidation extends to about midway between the first and second levels; in this rock, well defined pay-veins occur in which pink fluorite is the most striking feature. The open-cut contains two such veins with numerous interlacing branches of almost solid fluorine and granular quartz filling. They show an average regularity in dip and strike, making allowance for the usual vagaries of Cripple Creek veins, and they have been, on the whole, fairly productive. On entering the zone of disintegration, however, these veins are extremely difficult to follow, they contain little value and as a rule speedily disappear in that soft heavily ironstained material forming the zone of disintegration.

On the third level of the Deerhorn shaft, three tongues of massive crystalline gypsum occur, apparently of great purity though surrounded by dark reddish and brown clays, kaolin, and other products of rock decomposition. The gypsum is quite white and contains numerous bunches of crystalline pyrite, some of the cubes having quarter-inch facets, there are also some minute pyrite crystals disseminated in the mass of the gypsum. In places, fluorite occurs in sufficient quantity to give the rock a pinkish tinge: galena and other sulphides occur in occasional minute crystals disseminated in the gypsum; the outer boundary of the gypsum is everywhere corroded and plainly shows the action of some solvent, possibly water, about 400 parts of which will dissolve one part of gypsum, and with sulphurous acid present in solution this rock would be still more soluble. Thirty feet below the third level, the Deerhorn shaft passes into a solid mass of gypsum and continues therein to the bottom, or sixth level. The western limit of the gypsum deposit is clearly determined by the westerly cross-cut on the fourth level, as is also the limit of the zone of disintegration. The eastern limit of the deposit is shown on the fifth level, where the station is cut in the east side and a cross-cut extended easterly through the gypsum; there are no workings on the west side, but by constructing the western limits from the fourth and sixth level exposures, the gypsum would appear to be about 240 ft. thick at the horizon of the fifth level. The east cross-cut on the fifth level intersects two pipes, water-courses of oval shape, the longer axis being at right angles to the plane of section. These pipes had been at least partly filled with the loose ferruginous clay that surrounds the gypsum deposit in the zone of disintegration. The timbers of the level having decayed and broken down so as to allow the contents of the pipes to cave to a considerable extent, I was enabled to pass into some of the pipes and examine them closely. They appear to be openings along lines of fissuring and were water-conduits of some sort, though now dry as a bone and quite warm. While it is possible these pipes may have been formed by the solvent action of descending waters—and there is strong evidence of such action—yet they so strongly resembled in form of crustification and in general appearance, the pipes of thermal springs I had seen in New Zealand that I had no hesitation in believing them to be of similar origin, though in places enlarged and changed by re-solution of the gypsum since the close of thermal activity and the lowering of the water-level of the district permitted the descent of surface waters in the pipes of the original hot springs.

The sixth level (575 ft. from surface) is the bottom of development in the Deerhorn mine; no work had been done in an easterly direction, while the west cross-cut was (at the time of my visit) caved at about 60 ft. from the shaft and the level filled with reddish earth, whether from a pipe or the outer boundary of the gypsum I could not determine. Rickard, however, calls attention[1] to an outlier of gypsum at this point, which he examined while the original development was in progress. This is my authority for the western column of gypsum on the sixth level; the eastern wall of the pipe was, however, exposed for some height above the level and appeared in every way similar to those I had the opportunity to examine. A drift extended 50 ft. southerly from the station (along the strike of the deposit) through solid gypsum. At this point another pipe is revealed; it also was filled with reddish clay which had in part caved, closing the level, but permitting a complete examination of the pipe for 30 ft. above; it looked like a water-course. My note reads: "It is truly water action that has dissolved this space in the gypsum, which is simply a water-course filled with red ash and debris from above, brought down from the oxidized ground surrounding the gypsum." The study of the other pipes

[1] T. A. Rickard, 'The Cripple Creek Volcano.' *Trans.* A. I. M. E. Vol. XXX, p. 399.

led me to the conclusion that they were first thermal conduits, afterward enlarged in places by the solvent action of descending waters. All the workings described on the sixth level are in massive gypsum of varying purity, that at the bottom of the shaft is white and crystalline, shading toward pink in places, possibly from the presence of fluorite; no bedding structure could be observed; very fine pyrite crystals are disseminated all through the white gypsum, while the impure variety contained some dark sulphides, mostly pyrite, on the joint-plane and surrounding pieces of altered breccia. West of the station the rock has the appearance of a fine breccia saturated with, and cemented by, gypsum differing much from the white variety at the shaft. This



gypsum rock stands quite well even without timbers, it does not appear to soften or slab in the least. The workings were dry and the temperature I would judge at about 80° F.; on account of the caves there was no circulation of air, nor was there any accumulation of carbonic acid gas so prevalent in other mines in this vicinity.

At the time of the geological examination of the Cripple Creek district by Cross and Penrose, developments in the Summit mine had reached a depth of 200 ft. and in the Deerhorn 280 ft.[2] In discussing the evidence of fumarole action Cross says: "Gypsum occurs in the Deerhorn mine on Globe hill, in ore veins, and is most probably the result of aqueous action." Penrose considers the gypsum "possibly, though not necessarily, the product of the action of sulphuric acid or sulphates derived from the oxidation of sulphides on carbonate of lime or other calcium compounds derived from the alteration of certain eruptive rocks." Regarding the occurrence of the gypsum, this observer states: "In a vein on the 280-ft. level of the Deerhorn mine considerable quantities of a compact, fine grained crystallized gypsum, containing more or less fluorine, occurs; while on some of the upper levels thin layers and crystals of gypsum are found in the cracks in the breccia." Rickard, in speaking of the Deerhorn gypsum deposit, says: "There can be no doubt as to the nature of these masses of gypsum. Thermal springs that have become extinguished are marked by just such accumulations of lime, although the carbonate is, under such circumstances, more common that the sulphate. The flow of hot water encountered in the deep workings of the Comstock carried a notable percentage of gypsum." Lindgren proves[3] the presence of sulphates in the circulating water during ore deposition, by the "almost universal occurrence of celestite or sulphate of strontium in the veins, as well as by the more sparing development of barite. . . . Calcium sulphate is not found as a primary constituent of the veins, but the peculiar occurrence of large masses of gypsum associated with pyrite and fluorite at the Deerhorn mine, leads to the belief that waters rich in sulphates of the alkaline earths appeared as one of the latest phases of thermal activity. The closest analogy to this would perhaps be found in

[2] 'Geology and Mining Industries of the Cripple Creek District.' Washington, 1885.

[3] 'Geology and Gold Deposits of the Cripple Creek District Colorado.' Professional Paper 54. Washington, 1906.

the hot waters of the Comstock lode, which are exceptionally rich in these constituents." It appears that the lower levels of the Deerhorn were not accessible during the examination of Globe hill by Lindgren and Ransome, who quote from Rickard's description of the gypsum deposit and zone of disintegration. Regarding the latter, we find on page 197: "The explanation of this unusually deep oxidation is probably that extensive shattering preceded a local and very intense thermal-spring action, which by dissolving much material rendered the breccia so porous as to fall an easy prey to oxidizing processes." The gypsum in "the Deerhorn mine is, however, probably not formed during oxidation, but is more likely a primary deposit by hot waters."

The authorities quoted are in agreement that the gypsum deposit is the result of thermal-spring action occurring toward the close of volcanic activity; it must be noted, however, that pyrite and fluorine were deposited with the gypsum and very probably throughout the space now represented by the zone of disintegration. Gypsum is of common occurrence in sulphate springs, hot and cold. Flourite has also been detected in thermal springs of low temperature, as, for example, the mineral springs of Schwollen, in the Duchy of Oldenburg, to the extent of 0.0005 gram per litre, and at those of Baden to the extent of 0.0021 gm. per litre, while the deposit from the Sprudel water at Carlsbad gives practically 1% calcium fluoride.[4]

The source of the gypsum on Globe hill is probably from below, that is, from a greater depth than is revealed by any workings today; as a possible source of sulphate waters, Gautier has shown[5] that granite heated in a sealed tube with water to a temperature of 250 to 300°C. yields sulphur compounds in solution, resembling the sulphur waters of hot springs. He ascribes the sulphur to reactions on sulpho-silicates such as haüynite and lazurite, and not to metallic sulphides. This conjecture is interesting; from the granite could be obtained both the gypsum and the fluorite, as it is well known that fluorine compounds are specially characteristic of plutonic rocks, and, indeed, it has been recognized in Cripple Creek granite. The enrichment of the zone of disintegration by iron and manganese oxides remains to be considered. The composition of the average rock of the Cripple Creek volcano is computed by Lindgren at about 3% mixed ferric and ferrous oxides. Practically all of the spongy rock-mass in the zone of disintegration is heavily saturated with iron oxide; some of it is almost a low-grade iron ore. Where, it may be asked, did this great quantity of iron come from? It saturates a channel of porous rock about 1000 ft. long, perhaps a similar depth, and, say, 600 ft. wide, all of which contains much more iron and manganese oxides than the average oxidized mineral veins of the district. Two sources suggest themselves: one by descent from oxidation of the superincumbent breccia, since removed by denudation: secondly, from the oxidation of pyrite deposited in the altered breccia itself, say, at the beginning of solfataric action. I am rather in favor of the latter hypothesis. It must not be forgotten that gypsum is much more soluble than celestite and may easily have been leached out of the veins by circulating solutions, hence, the possibility of the closing period of vein formation being coincident with solfataric action, at Globe Hill, for example, where the simultaneous deposition of pyrite, galena, fluorite, and gypsum affords at least some evidence in favor of such phenomena. It may be claimed that the gypsum deposit is a local occurrence, and to a large extent it is, for I take it that the sulphate solutions that built up the great mass of gypsum rose along lines of fissures, dissolving and replacing the breccia in their neighborhood. I could not conceive a cavity representing the proportions of the gypsum deposit remaining open during the long period necessary for the deposition of the gypsum mass; furthermore, we have in the partial replacement of breccia in the gypsum at the sixth level what I take to be direct evidence in favor of a replacement process.

The periphery of the gypsum deposit, at the few places where I could examine it, showed strong evidence of partial solution; at such places it is surrounded by very loose iron oxide conforming to the configuration of the gypsum, while the latter is pitted with numerous cavities and corrugations, but is quite solid, showing no graduated passage from the solid gypsum to the decomposed breccia; hence I believe the deposit was much larger before the period of oxidation set in, and also extended much higher than the present section shows; the peculiar fin-shaped pieces exposed on the third level are in themselves evidence of solution.

The phenomena of volcanic action and rock oxidation on Globe hill suggest the following tentative cycle of events:

(a) Fissuring of the breccia and general shattering of the rock in the main channel, followed by fumarole action with kaolinization of the feldspars, closing with the deposition of minerals in the veins and pyrite in the partly decomposed breccia; this is perhaps more correctly classed as the early solfataric stage.

(b) Solfataric stage, deposition of gypsum, pyrite, etc., from sulphate waters along lines of fissuring, and, in part, in the spongy breccia of the shattered zone, closing with thermal waters rising in pipes to the then surface of the ground, said pipes being somewhat centrally placed in the mass of gypsum.

(c) Oxidation period. Descending meteoric waters dissolve the upper portions of the gypsum and the less solid portion around its periphery and to some extent enlarging the pipes of the original springs. At the same time, the pyrite in the shattered breccia channel was oxidized, completing the disintegration of the rock and forming the zone of disintegration as we now see it, much of the iron, of course, was removed in solution, but enough remains to show that at some time this great channel was, as I take it, very thoroughly impregnated with pyrite.

[4] Prestwich. 'Geology Chemical and Physical.' Vol. 1, pp. 340-341, 1886.

[5] *Comp. Rend.* Vol. 132, p. 740, 1901.

MINING CLAIMS ON FOREST RESERVES.

By the courtesy of Mr. Horace V. Winchell we are able to present a draft for a memorial to Congress submitted for the consideration of a committee on the revision of the mining law of the United States appointed by the Montana Society of Engineers. Mr. Winchell remarks that "it voices the complaints which are now becoming very common against the present system of inspection of mining claims located under the mineral land laws of the United States. I am aware, from personal inspection, of injustice in a number of cases, and I am convinced that the present method is extremely faulty." The memorial recites:

In the State of Montana, practically all of the mountains have been set apart as National forests, leaving only the bare bench and valley lands open to appropriation under the agricultural laws. Since the mountain districts are practically the only regions where mines are exposed, it follows that these reserves include nearly all of the territory in the State of Montana upon which a prospector can look for mines. Congress has enacted that mines may be located upon National forests as elsewhere. And if this law were interpreted by the officers of the Land Department in accordance with its spirit, we should have no complaint to make, but it is interpreted in so narrow and suspicious a spirit as to make it exceedingly difficult and in many cases impossible to secure patents for mining claims upon forest reserves. In a little book entitled 'The Use of the National Forests,' by Gifford Pinchot, Chief Forester, a book intended for the reading public, the following directions are given under the head 'Prospecting and Mining': "Proceed just as on the open public domain. National forests do not interfere with these matters at all." These sentences, we maintain, are misleading, for, as a matter of fact, a miner on a forest reserve cannot proceed just as on the public domain, and it is not true that National forests do not interfere with the development and acquisition of title to mining claims. In the 'Use Book,' consisting of regulations and instructions for the guidance of the officers of the forest reserves, such minute and exacting requirements are made in regard to the examination and tests of mining claims by the forest officer as to make it a very exceptional and rare prospect indeed that will pass the scrutiny. The officer must measure the width of the vein, sample each grade of ore, carefully wrap and label the sample, place it under lock and key to prevent 'salting' and in the event of a contest or adverse report by the inspector, he must send it to the assayer of the mint at Denver, Carson City, or Seattle to be assayed. Upon the basis of this investigation, the officer decides whether or not the claim is of commercial value. If not of commercial value, nor capable of being made so immediately, the claimant's application is rejected.

The laws of the United States permit a claimant to apply for and secure patent after the expenditure of $500 worth of work upon a mining claim. The Courts, both Federal and State, have held that in the absence of an agricultural contest for the land, small evidence of actual ore-value need be shown in order to uphold a mining location. It is a rule practically universal in the Courts that if the vein or lode located is such as to justify a person of ordinary intelligence in following up the indications of ore, and in expending his time and money in its development, it affords a sufficient discovery to justify and uphold the location. But the officers of the Land Department require very much more stringent tests. They apply such tests as are applied to a fully developed and marketable mine.

These tests are unauthorized by law, entirely unreasonable, and unduly exacting, and have been formulated by some person or persons who are ignorant of the conditions of ordinary mining. Such tests have never been applied before in the history of mining in the United States. The laws of the United States require only $500 worth of work to be performed or improvements to be made upon a mining claim before one may apply for patent. When these improvements have been made, if he has a vein such as the Courts have held sufficient to justify the location, he is entitled to a patent under the laws of the United States, whether the claim be situated upon a forest reserve or elsewhere. The officers of the National forests have formulated rules practically nullifying the laws of Congress, and with which it is almost an impossibility to comply, notwithstanding the entire good faith of the applicant. Five hundred dollars does not go far, as a rule, toward developing a paying mine, and after the expenditure of that sum it is a rare mine indeed that will respond to the tests required by the officers of the Land Department. We speak from knowledge when we say that the great Anaconda mine in Butte would not have responded to these tests. The same is true of the St. Lawrence, Mountain View, Rarus, Minnie Healey, Speculator, and many other mines in Butte that have produced millions, the names of which are familiar to people throughout the mining world.

It requires a mining expert of rare judgment and foresight to determine the prospective value of a mining claim, and even men of the highest qualifications in this respect sometimes find that their unfavorable judgment of a mining claim has proved erroneous and short-sighted. The Land Department does not employ men who are entitled, if judged by ability and experience, to be called mining experts, yet the value of a prospector's claim is at the mercy of the judgment of these pseudo-experts. It is true that the claimants can appeal, but appeals are expensive, and cause much delay and annoyance, even though it should eventually be proved that the locator has acted in entire good faith. The Supreme Court of the United States has held that the officers of the Land Department are the final judges as to the character of the land, and from their decisions, based upon the testimony of their mineral experts, there is no appeal.

Even where a special agent approves a mining claim, his very approval seems to be regarded with suspicion by his superiors, resulting often in the sending of a second special agent to examine the

same mining claim, and resulting in long delays and often the ultimate refusal to permit the mineral entry of the claim.

The entire administration of the Land Office in the State of Montana seems to be permeated with the spirit of suspicion and espionage. This spirit also fosters and causes opportunity for blackmail. Claimants who have been defeated in the courts in a mining contest carry their grievances to the special agent, making charges of insufficient work by the adverse claimant, or lack of good faith in some other respect, and the special agent is in a position to suspend action upon the application until it shall have been subjected to a hearing before the Land Office.

There is another grievance which mineral applicants have against the present administration of the law, that applies not only to National forests but to the open public domain as well. It often happens that shafts and tunnels representing part of the $500 worth of work have caved when application for patent is made, or cuts and bed-rock drifts in placer workings have washed full of gravel during the spring freshets, so that they are inaccessible. Hitherto it has been the custom of the Land Office to require the affidavits of two disinterested witnesses, conversant with the facts, as to the character and extent of these improvements. But recently the affidavits of such witnesses have been dispensed with. A special agent, furnished only with the published notice of application for patent, which does not go into the details of improvements or their application, now goes upon the ground without any notice to, or assistance from, the applicant. The claimant's point of view is a matter of utter indifferenee with him. If a 50-ft. shaft has caved to within 10 ft. of the surface, the special agent reports a 10-ft. shaft only. If placer workings have washed full of gravel, he reports no improvements found. If a 100 or 500-ft. shaft has been sunk to represent a group of claims, he reports this work on the claim upon which the shaft is found, and reports adversely upon the others. In the book above referred to 'The Use of the National Forests,' Mr. Pinchot says: "National forests exist today because the people want them. To make them accomplish the most good the people themselves must make it clear how they want them run." This invitation to the people is an invitation to mining men everywhere to offer suggestions as to how the mining laws of the United States should be administered upon the National forests and upon the open public domain of the United States, and it is in order for them to consider the matter and formulate such suggestions.

Copper-Leaching Process.—O. Frölich, in a paper recently read before the Elektrotekniscne Verein, proposes, instead of roasting the ore, to heat it to about 800°C. in a retort furnace out of contact with air. One-fourth of the sulphur distils over as such, and the ore itself is disintegrated so that it can easily be lixiviated with a solution of ferrous chloride and common salt. This operation is hastened by mixing by means of a screw mounted vertically in a steam-jacketed vat.

AN INTERESTING TELEGRAM.

It is our privilege to present an exact copy of the telegram on which the Tonopah mine, now owned by the Tonopah Mining Co., was purchased. It is a document of historic interest in the annals of mining, representing a case in actual life of estimating available ore of fabulous value while the property itself remained a mere prospect. The realization of this sort of wild dream in which the prospector indulges, and which the promoter heralds to the world, seldom comes. In this instance it did.

Reno, Nevada, June 5, 1901.

Hon. John W. Woodside,
931 Chestnut Street,
Philadelphia, Pa.

Tonopah mines greatest surface showing ever discovered. Thirty-seven holes on eight claims producing both milling and shipping ore. Many others producing fine milling ore, all being worked by tributers. Net profits to owners one thousand dollars daily on ore shipped; have bought these eight claims for three hundred and thirty-six thousand dollars. Fifty thousand payable June 28th. One hundred thousand October 1st, and one hundred and eighty-six thousand December 20th. Have drawn on you for first payment. Draft due at Penn Bank, Philadelphia, June 28th. Under my agreement, tributers may work their ground until December 31st, but all royalties received by owners after June 1st, to be applied on purchase price and to be subtracted from our last payment. We may enter upon any part of ground, and mine after meeting first payment. At least one million dollars in sight above fifty-foot level. Deepest shaft seventy feet, vein there six feet. Five feet forty dollar rock one foot three hundred dollar rock. Eighty thousand to one hundred thousand dollars worth of forty dollar milling rock now on dumps. One-fourth of this and one-fourth of all mined hereafter comes to us and we can ask all we want for milling other three-fourths owned by tributers or buy them out at our own figure when reduction works are ready. Will mail full particulars in few days. You must get the money to meet this draft without fail. I cannot get the time extended. Wire me at Grass Valley.

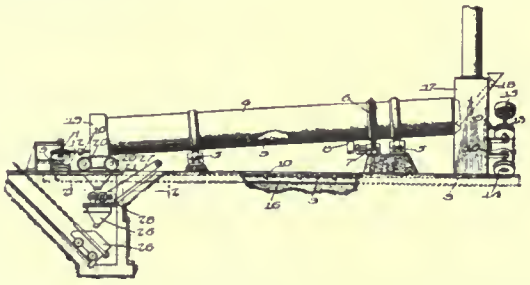
(Signed) O. A. Turner.

Coal value, estimated in terms of heating power expressed in British thermal units, is becoming the basis of sale in England, instead of quoting so much per ton. Contracts are made to deliver a certain number of B. T. U. per penny, varying from about 270,000 to 320,000 moist, or 290,000 to 343,000 dry. The calculation, according to J. B. C. Kershaw in *Cassier's Magazine*, is made by the following rule: multiply the number of British thermal units per pound of dry coal by the percentage of moisture, subtract the product so found from the total number of B. T. U. per pound of dry coal, multiply the remainder by 2240, and divide this product by the contract rate per ton (expressed in pence), plus one-fourth the ash percentage. Payment is adjusted to the actual number of heat units delivered.

MINING AND METALLURGICAL PATENTS.

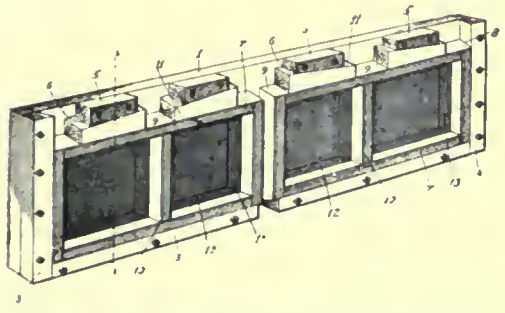
Specially Reported for the MINING AND SCIENTIFIC PRESS.

METHOD OF PREPARING ORES FOR USE IN THE MANUFACTURE OF STEEL.—No. 887,379. Eugene B. Clark, Chicago, Illinois.



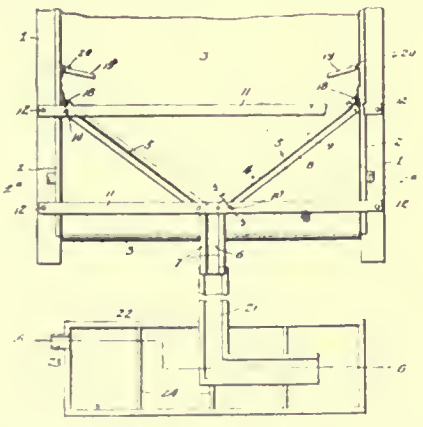
The method of treating fine ores for the purpose described, which consists in passing the ore through a substantially horizontal cylindrical kiln wherein it is reduced to a semi-plastic condition by heat, the kiln being meanwhile rotated to agglomerate the ore into small homogeneous lumps, and then compressing such lumps into larger lumps or blocks.

BATTERY SCREEN-FRAME FOR QUARTZ-MILLS.—No. 889,380. Robert E. L. Lampson, Jamestown, California.



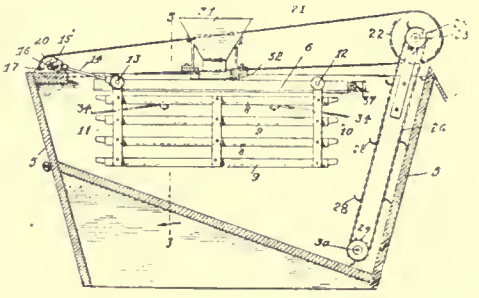
In a device of the character described a main frame, strips along one edge and both ends of the face of said main frame, the inner edge of said strips being beveled inward, auxiliary frames having outwardly beveled edges adapted to be inserted under said first named beveled edges, means at the ends beyond the perforations; and means to move tween said main and auxiliary frames as described.

SLIME-SAVING DEVICE FOR ORE-CONCENTRATORS. No. 889,300. Bert E. Duggan, Telluride, Colorado.



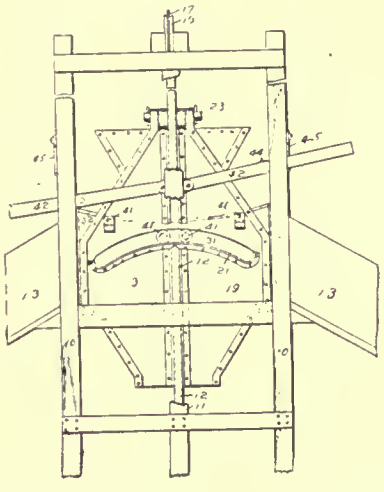
The combination of a stationary frame, a movable frame, a concentrator table arranged upon said movable frame, a pair of cross-bars arranged above the table and having their ends formed with threaded apertures, nuts arranged upon the main frame, upright screw-rods having centrally arranged flattened enlargements and oppositely screw-threaded ends, their upper ends being engaged with apertures in the cross-bars and their lower ends with said nuts, a slime-skimming device arranged above the table and having a Y-shaped body, one of its branches being trough-shaped to provide a discharge spout and its other two branches being angular in cross-section and having horizontal flanges engaged with the bottom faces of said cross-bars, and bolts securing said flanges to the cross-bars, substantially as set forth.

GOLD-SAVING MACHINE.—No. 890,059. Thomas Hussey, Hollywood, California.



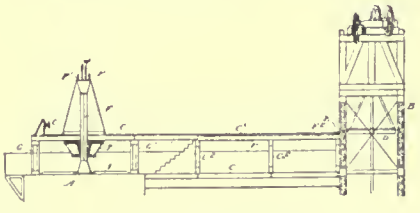
In a gold-saving machine a concentrator pan having a corrugated bottom provided with perforations in the apices near the ends thereof, said bottom being turned upwardly at the ends beyond the perforations; and means to move said pan horizontally in the directions that the corrugations run.

MINE-ELEVATOR.—No. 890,124. William Channon, Des Moines, Iowa.



In a device of the class described, the combination of an elevator cage, a platform tiltingly mounted in the cage, an elevator guide terminating at the dumping point, two rollers fixed to the tilting platform and extended outwardly beyond the side of the cage, and in engagement with the opposite sides of said guide, and weighted levers pivoted in the path of the dumping platform and arranged to be engaged by the dumping platform when the rollers reach the end of the guide to thereby tilt the platform, and to yield sufficiently when engaged by the tilting platform to prevent breakage and undue strain upon the parts, and means for holding said weighted levers in elevated positions.

BLAST-FURNACE CHARGING APPARATUS.—No. 888,723. David I. Miller, Sheffield, Alabama.



In a blast-furnace charging apparatus, the combination of a blast-furnace having a hopper and bell, a charging bridge, a horizontally disposed track elevated above the charging bridge and projecting over the blast-furnace hopper, a charge-distributer interposed between the elevated track and the blast-furnace hopper, an elevator having a track section, and a movable or floating track section interposed between the elevated bridge track and the elevator track section.

MINE REPORTS.

ANACONDA COPPER MINING CO., BUTTE, MONTANA.

The mines and reduction works of the Anaconda Copper Mining Co. were operated fully from the beginning of the year until September 1, except for some interferences resulting from extreme cold weather, which delayed transportation of ore and fuel during the months of January, February, and March. The condition of the metal market and the accumulation of unsold product, commencing with July, made it desirable, in the opinion of the trustees, to restrict the expenditures and the output of copper until such time as the market would absorb the product, and commencing with September the production was sharply curtailed, until it reached as low a point as 35% of the normal. General business and financial conditions throughout the country later preventing any recovery in the market for metals, and the low rate of production making necessary increased costs of copper, it was decided at the beginning of December to close the mines and works of the company entirely, until conditions should show improvement. The high price of copper prevailing during the first six months of the year made it seem advisable to treat ores of a lower grade than had been extracted in any previous period in the Company's history. Much of the product resulting from the treatment of these ores was not marketed until the late months of the year, when the price of copper had receded to a point where the profit on this production was much smaller than had been anticipated, as the product of ores mined as early in the year as March was not sold until the latter part of the year, at prices 10 to 12 c. per lb. lower than were ruling at the time the ore was extracted. The copper on hand at the end of the year was produced during the period of curtailment and cost $163,105 in excess of the amount realized from its sale. In order to keep this loss in the year during which it was made, the amount has been deducted from the profits of the year, as shown by the profit and loss statement. All these conditions have resulted in a profit very much less than anticipated at the beginning of the year. Out of surplus for the preceding year and profits for 1907 dividends were declared amounting to $6,300,000.

The mines and works of the company were not in operation during January and February. In the early part of March work was again started, and in the latter part of the month production had about reached the normal. The production figures and rough costs for March and April show a considerably higher grade of ore and a lower cost per pound of copper than have been realized at any time during the last few years. Early in the year 1907 it was considered advisable to grant a general advance in wages; contracts were entered into with labor unions holding in their membership nearly all of the employees of the company. These contracts provided for an advance in wages during the time when high prices prevailed for copper, and in the month of October, the price having receded below the dividing line, wages in all departments of mining and smelting were reduced, in accordance with the contracts, to the scale prevailing early in 1906. The contracts made with the labor unions were complied with in all respects, without any attempt at evasion on the part of either party.

Considerable development was done in most of the mines of the company during the year, the large part of it being lateral development; the only shaft deepened during the year being the High Ore, which was sunk 293 ft., the depth at the close of the year being 2880 ft. A station has been cut on the 2800-ft. level, but no development of the veins has been made below the 2600-ft. level. At the time of the last annual report the main Anaconda vein had been cut and levels driven on the 2000-ft. level of the St. Lawrence, 2200 and 2400 of the Anaconda, and the 2200 of the Never Sweat. There has been practically no stoping done on these levels during the year past, but at the time of resumption of operations in March stoping at various points on these levels was commenced, as it is desirable now to mine a higher grade of ore than during the early part of the year 1907. The South vein in the Anaconda group has been opened on the 1800, 2000, and 2200-ft. levels of the Anaconda, and for the entire distance developed the vein shows good width of ore, one-half of which is apparently smelting grade. In the St. Lawrence mine in the upper levels a new vein has been opened for a distance of 500 ft., showing ore of good concentrating grade.

Electric locomotives have been installed on several important levels of the Anaconda group and are giving satisfactory results in efficiency and cost of haulage. A new compressor building was erected at the Diamond mine and the plant is now in full operation. It contains four electrically driven air-compressors, with a total capacity of 16,000 cu. ft. of air per minute, all fitted with steam cylinders for use in case of failure of electric current. The compressors were taken from different mines, and only two new low-pressure cylinders of 38¼ by 48-in. were added. Four new 600-hp. alternating-current electric motors, two circulating pumps, and four 5-ton traveling cranes were purchased and installed. The Never Sweat compressor-plant now consists of five compressors, with a capacity of 32,000 cu. ft. of air per minute, two of the largest being electrically driven. This plant is connected with the Diamond plant by a water-pipe, so that water can be pumped from one plant to another, and the two are connected with all of the mines of the company and the compressor plants of the Boston & Montana Co., so that in case of accident at any of the most important

PROFIT AND LOSS ACCOUNT OF YEAR ENDING DECEMBER 31, 1907.

Copper, silver, and gold on hand at beginning of year—copper at cost, silver and gold at selling price	$ 5,306,003.08	Sales of copper, silver, and gold, that is, deliveries to customers	$12,038,714.69
Mining expenses, including development and depreciation	5,241,704.28	Royalties	38,830.92
Ore, matte, and copper purchases, including transportation and purchasing expenses	210,630.33	Dividends on investments	33,553.00
Transportation of ore from mines to reduction works	153,139.99	Rental of water-rights	50,000.00
Reduction expenses at Anaconda, including depreciation	3,640,295.47	Miscellaneous receipts	6,109.96
Transportation of metals from west to east, refining and selling expenses	997,938.75	Net profit of subsidiary departments, after deducting depletion of coal and timber lands and depreciation of plants and equipment	581,281.74
Administration expenses	53,648.59	Copper, silver, and gold on hand at end of year—copper at cost, silver and gold at selling price, $6,165,748.78; less loss on realization of copper on hand, $163,105.33	6,002,643.45
Balance, being profit before dealing with interest, carried down	3,147,773.27		
	$18,751,133.76		$18,751,133.76
Balance, being profit, carried to balance sheet	$ 3,378,220.42	Balance brought down	$ 3,147,773.27
		Interest	230,447.15
	$ 3,378,220.42		$ 3,378,220.42

compressor plants of the district, air can be furnished by the others to keep the mines in operation.

The mines of the Company produced during the year 1,123,692 wet tons of ore. The reduction works treated for all companies during the year 2,582,611 dry tons of ore and other copper-bearing material. Of this, 1,110,203 tons of ore from the mines, 2966 tons of concentrate, 16,250 tons of slime, and 24,226 tons of slag from the old works was treated for the Company, from which there was produced 63,055,661 lb. fine copper.

Since February, 1907, electric power has been used at the concentrator and in other departments of the works. This power has been found efficient, and the cost much below that of steam for the same work. The large part of the electric power furnished at the works is brought from the Missouri river, but during the year the Flint creek water-power and electric plant has been furnishing a considerable amount of current, and the Washoe Co. installed in its sub-station at the works three 400-kw. transformers, one voltage regulator for the city lighting system, and additional switchboard capacity for the new blast-furnace blower-house. In the smelter power-house there were installed one 600-hp. motor, one 750-hp. motor for blowing engines, and one 600-hp. motor for a air-compressor. An entire new blower-building was constructed, with 15-ton crane for handling machinery, four 600-hp. motors, and four blowers, each with a capacity of 36,000 cu. ft. of air per minute. This plant was just about ready for operation at the time of suspension of work late in the year. The McDougall building was extended, and eight additional roasters with equipment were completed.

NUNDYDROOG CO., LTD., OORGAUM, SOUTH INDIA

The Nundydroog Co., Ltd., paid its first dividend on October 18, 1888, amounting to £25,840. The earnings rapidly increased, under the efficient direction of John Taylor & Sons, the consulting engineers to the company, so that, including the last dividend of £99,050, distributed on March 20 last, the total return to the shareholders in 27 years has been £1,340,076. During the year 1907 the mills of the Company treated 84,000 tons of ore, producing 66,696 oz. gold, and there was cyanided 83,970 tons of old tailing, yielding 8268 oz. gold. The gold bullion yielded £283,138, included in which is £1607 received for gold obtained from slags and crucibles, representing 0.56% of the total. The number of employees working on December 1, 1907, was 3918, of whom only 70 were Europeans. Among the natives employed were 238 women, these being engaged in such work as tramming, charging and discharging cyanide vats, helping on construction, and sweeping. The development work for the year has demonstrated the extension of the vein to a depth of 2150 ft., and has added 38,640 tons to the ore reserves, bringing up the aggregate to 111,640 tons, or about one and one-third year's supply at the present rate of milling. The mill, containing 80 stamps, weighing 840 lb. each, made 346½ days' time during the year, with an average stamp-duty of 3.03 tons per stamp per diem, crushing to 30 mesh. The recovery of gold per ton of ore milled was 0.793 oz. worth $16.39, U. S. Cy. and the total costs were $7.84, showing a gross profit of $8.55 per ton. Analysis of costs of operation are not given, the minutiae of the reports dealing with mine development. While this accentuates the point of first importance, which is too often ignored by directors content to believe that they have a mine on which they may depend detail as to the metallurgical work is also interesting and useful. The company proposes in future to provide all capital expenditure out of profits, instead of issuing fresh capital for improvements as in the past. The expenditures for betterments during 1907 amounted to £14,751. Power for the operations of the Company is developed electrically, a contract having been made a little over a year ago, whereby 911 hp. are delivered at a cost of £10 per horse-power per annum. Previously power cost £24 for the same unit. There were some interruptions in the delivery of power during the year owing to shortage of water. The average normal rainfall in the district is 30.94 in. During 1907 the precipitation was only 22.41 inches.

Decisions Relating to Mining.

Specially reported for the MINING AND SCIENTIFIC PRESS.

DEFINITIONS OF LODE AND PLACER LOCATIONS.

A lode location is the location of a vein or lode in mineral-bearing rock or other earthy matter in place in a fissure in rock, so that its boundaries are sharply defined by rocky walls in place. A placer location is a location of a tract of land for the mineral-bearing or other valuable deposits upon or within it, that are not found in lodes or veins in rock in place; and is a claim of a tract of land for the sake of loose deposits on or near its surface.

Webb *v.* American Asphaltum Mining Co., 157 Fed. 203, Nov., '07.

METALLIFEROUS AND NON-METALLIFEROUS SUBSTANCES.

Section 2320 of the U. S. statute specifies the method by which veins or lodes of quartz or other rock in place bearing gold, silver, cinnabar, lead, tin, copper, or other valuable deposits, may be entered and patented. And the terms, "all mineral deposits," or "other valuable deposits," include non-metalliferous deposits, such as alum, asphaltum, borax, guano, diamonds, gypsum, resin, marble, mica, slate, amber, petroleum, limestone, and building stone, as well as metalliferous metal, such as gold, silver, and other metals.

Webb *v.* American Asphaltum Mining Co., 157 Fed. 203, Nov., '07.

DUTY OF SHOT-FIRER—CONTRIBUTORY NEGLIGENCE.

The statute of Missouri requiring the shot-firer, on discovering that a drill-hole is gripping too much, or that it is drilled too much into the tight, so that it may, in his judgment, prove dangerous, to pass it without firing and promptly notify the mine foreman, only imposes diligence and caution on the shot-firer, and does not necessarily make him negligent in failing to discover the danger in a shot fired by him.

Kirby *v.* Manufacturers' Coal & Coke Co., (Mo. App.) 106 Southwest. 1069, Dec., '07.

COAL LANDS—TAXATION.

A tract of coal land of more than 1000 acres was leased for 100 years, a period supposed to be necessary under present conditions to mine and market the coal. Under existing circumstances it was not practicable to mine more than 85 acres annually, or 170 acres during an assessment period of two years. Under the assessment laws of Virginia that amount only should have been assessed for taxes as "improved and under development."

Commonwealth *v.* Pocahontas Coal & Coke Co., (Va.) 60 Southeast. 84, Jan., '08.

LOCATION OF MINING CLAIM—ABANDONMENT—RE-LOCATION.

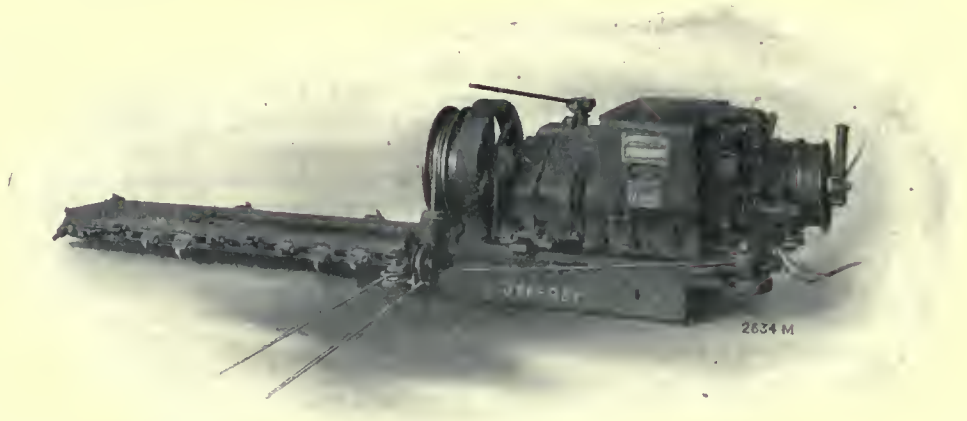
The United States statutes authorize a discoverer to locate a mining claim, and require the sinking of a discovery shaft before the expiration of 90 days from the posting of the notices of location; they also provide that locators of mining claims complying with the laws shall have the exclusive right of possession and enjoyment of all the surface included within the lines of location, and all veins, lodes, and ledges throughout their entire depth, the top or apex of which lies inside of such surface-lines extending downward vertically within planes drawn through parallel end-lines; and that the location must be distinctly marked on the ground, so that its boundaries can be readily traced, and that until a patent has been issued not less than a specified amount of work shall be performed each year, or the claim may be open to re-location. Under these statutes a junior location made on ground covered by a valid existing senior location will not prevail over a location on the same ground, made after a failure to do the work on the senior location. Such a re-location is not affected by the statute under which the claimant, by failure to assert his rights acquired, may lose them.

Nash *v.* McNamara, (Nev.) 93 Pac. 405, Jan., '08.

SHORTWALL COAL CUTTER FOR ROOM AND PILLAR.

The economy and speed with which coal is mined by longwall machines have given rise to a very large demand for an efficient machine operating on the longwall plan for room and pillar work. To meet this need the Jeffrey Mfg. Co. has added to its line of electric coal cutters a new room and pillar machine, known as the Jeffrey 26-B Shortwall Coal Cutter, illustrations of which are shown herewith. The difference between this and the well known breast machine is largely in the method of cutting. The new type cuts across the face of the coal, starting at one side of the room and not stopping until it finishes the cut at the other side.

A ½-in. steel feed-cable wound upon a power-driven drum at the front end of the machine pulls it across the face of the coal at a speed dependent upon, and suited to, the hardness of the cutting and the nature of the coal or clay in which the cutting is done. This drum when desired can be disengaged by means of a suitable clutch, so that the machine in finishing its cut at the left-hand rib may be angled for the purpose of maintaining a uniform width of room. Another cable, having no connection whatever with the power, is arranged to act as a guide to hold the machine to its work at the proper angle for its greatest cutting efficiency. Suitable sheave wheels are provided at convenient points on the machine to guide the feed-cable so that it can be led off in any direction, thereby enabling the machine



to be loaded, unloaded, moved about, and pulled out from under the coal by its own power, a desirable feature which strongly appeals to the machine-runners. The gearing is arranged so that the feed-drum may be operated at a sufficiently high speed to move the machine quickly about the working place. To meet conditions of heavy service, an exceptionally powerful compound-wound motor is provided. The operation of the machine may be briefly described as follows: It is brought into the room on a truck, moved by its own power or hauled by a mule. A pipe-jack is placed at the face of the coal at the right-hand rib and the feed-cable attached. The motor is then started and the machine moved to the face of the coal. A simple guiding device, consisting of a piece of tee-rail and one jack, is then set up on the left-hand side of the machine and the 'sumping cut' started, the feed-cable pulling the cutting-frame in under the coal and the guiding device serving to hold the machine in line. When the sumping cut is completed, a steel anchor-hook is secured by a wedge in the left-hand rib near the face, to which are hooked one end each of both the guide and feed cables which lead across the face of the coal. The cable is then attached to a jack set up at the right-hand rib in line with the rear drums, and the machine started across the room. In operation, the feed-cable pulls the machine across the coal face, and the guide-cable keeps it at the proper angle to the face of the coal.

A flexible brand of wire with elliptic strands is used for the feed and guide cables, eliminating any tendency to kink or curl when the tension is released, and materially increasing the wearing surfaces of the cable. The elasticity of the cable equalizes the shocks and jars on the machine and gives the motor an even steady load.

When the machine reaches the left-hand rib, the pipe-jack is moved to a position near the truck, the feed-cable attached, the machine pulled out from under the coal and over to the truck, where it is loaded by its own power and is ready to move to the next working place.

COMMERCIAL PARAGRAPHS.

BAINBRIDGE, SEYMOUR & CO. are removing their offices from 1 St. Helens Place, to Salisbury House, London.

W. A. STADELMAN, recently sales manager of the Wellman-Seaver-Morgan Co., is now vice-president of the DARLEY ENGINEERING CO., 80 Broadway, New York.

C. G. PATTERSON, of the BUTTERS VACUUM FILTER CO., is at Goldfield, Nevada, installing the Butters system of filters in the Goldfield Consolidated and Florence mills.

THE DARLEY ENGINEERING CO., Chicago, has issued a small pamphlet illustrating and describing its vacuum process of removing ashes and clinkers from boiler-rooms and furnaces.

THE DEISTER CONCENTRATOR CO., Fort Wayne, Indiana, has one of its slime-tables installed in the Combination mill, Goldfield, Nevada, where it is undergoing a test as to effectiveness and capacity.

THE CYCLONE DRILL CO., Orrville, Ohio, has issued a small booklet which it calls 'Does Well Drilling Pay?' and which will be sent free to any address. The pamphlet discusses the business of well drilling from the standpoint of the prospective driller.

THE PEMBERTHY INJECTOR CO., Detroit, Michigan, advises us that, beginning with the July issue, the *Engineer and Fireman* will be increased from a 32 to an 80 page magazine. Free sample copy will be mailed to any reader of the MINING AND SCIENTIFIC PRESS upon request.

PUBLICATIONS RECEIVED.

'Binders for Coal Briquets,' by James E. Mills. Bulletin No. 343 of the U. S. Geological Survey.

U. S. Geological Survey, No. 156, 'Elk Point Folio,' covering parts of South Dakota, Nebraska, and Iowa.

Illinois State Geological Survey Bulletin No. 7, on the 'Physical Geography of the Evanston-Waukegan Region,' by W. A. Atwood and J. W. Goldthwait.

The Gold Placers of Parts of Seward Peninsula, Alaska; including the Nome, Council, Kougarook, Port Clarence, and Goodhope Precincts. By A. J. Collier, F. L. Hess, P. S. Smith, and A. H. Brooks. Bulletin No. 328 of the U. S. Geological Survey.

THE GENERAL ELECTRIC CO. has invested in copper mining and milling properties $2,701,976, the principal property being the Bully Hill Copper Mining & Smelting Co., at Winthrop, Shasta county, California.

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